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The Engineer

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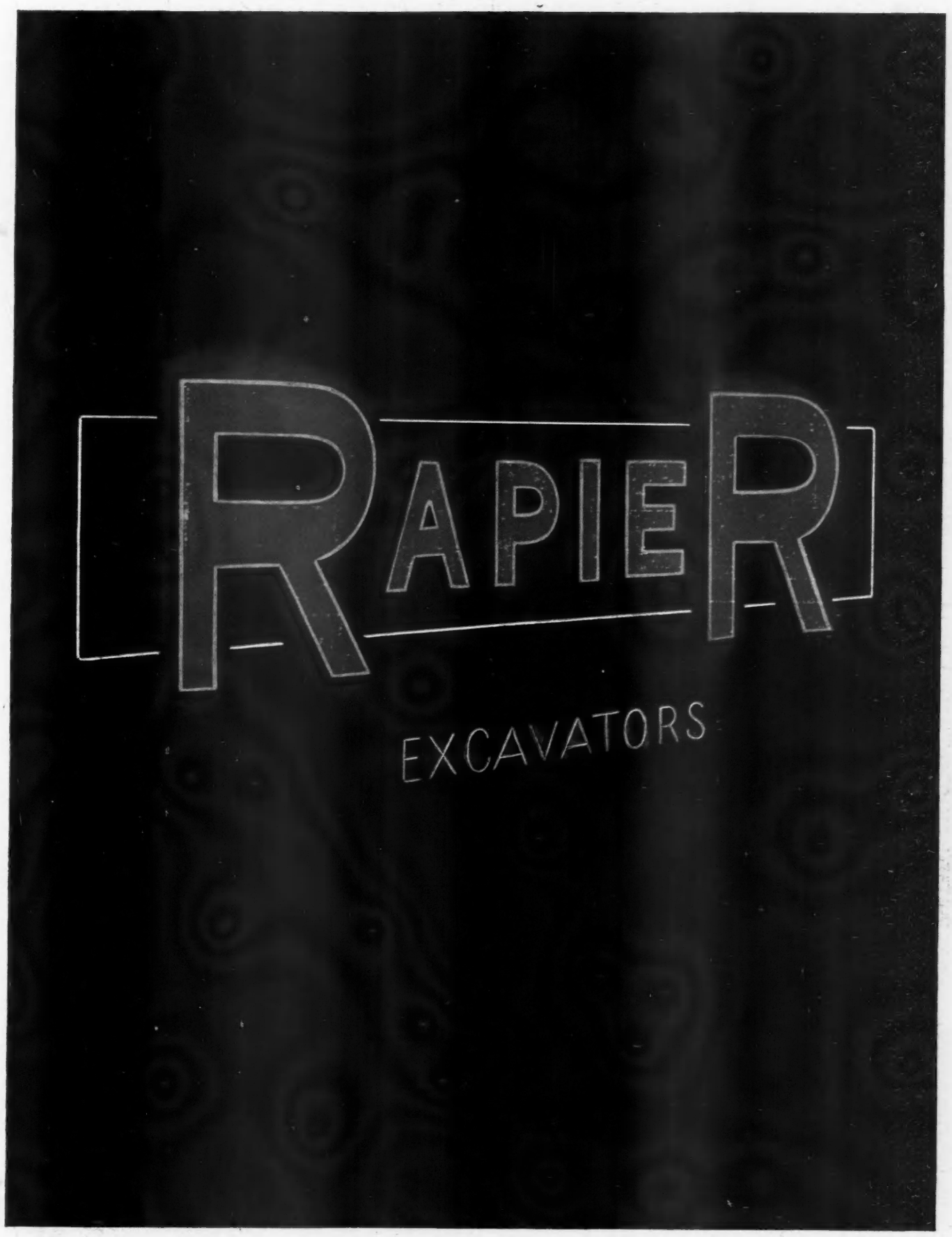
VOL. CLIX.—No. 4146] 28, ESSEX ST., LONDON, W.C. 2. [JUNE 28, 1935



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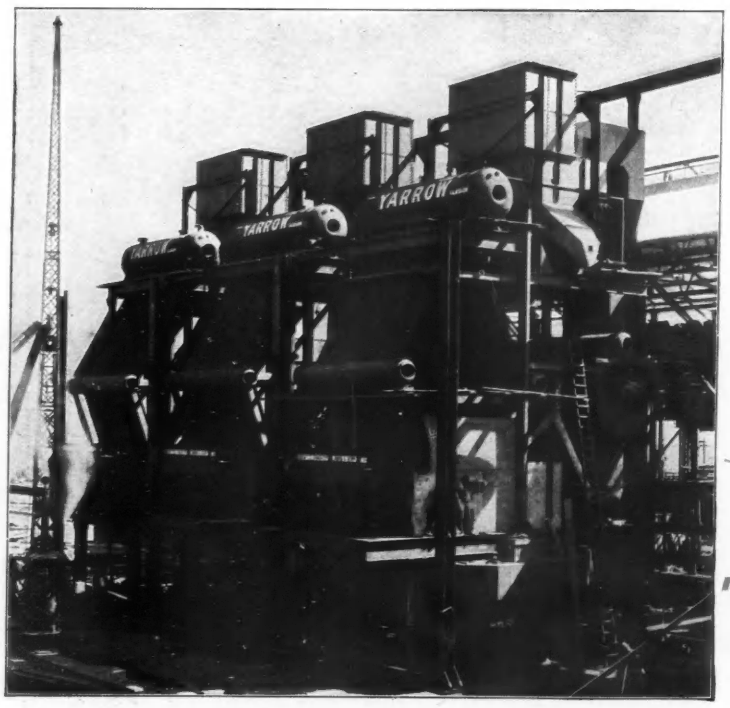
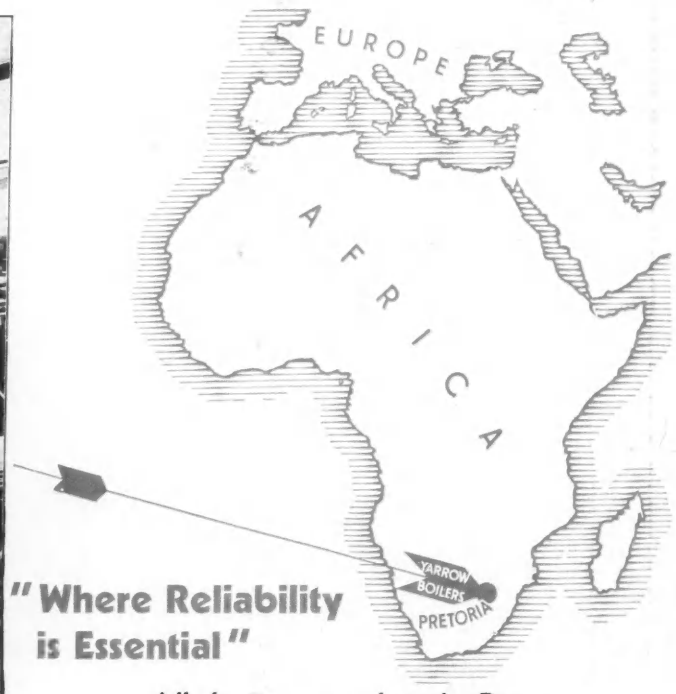


Three Yarrow Boilers in course of erection for the new plant of the South African Iron and Steel Industrial Corporation Ltd.



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"THE ENGINEER," JUNE 28, 1935

Printed on Thin Paper for Foreign Circulation.

With METALLURGICAL SUPPLEMENT.

The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 28, ESSEX ST., STRAND, LONDON. W.C. 2.

VOL. CLIX.—No. 4146] LONDON: FRIDAY, JUNE 28, 1935 [PRICE { WITH SUPPLEMENT / ONE SHILLING } BY INLAND POST 1s. 3d.

PUBLIC NOTICES.

Air Ministry.
AERONAUTICAL INSPECTION DIRECTORATE.
VACANCIES EXIST for EXAMINERS. Salary £246 a year, rising by eight annual increments, provided service is satisfactory, to £387 a year.
Candidates must be not more than 50 years of age on 1st August, 1935, have had good general education, served regular articles of apprenticeship or pupilage in Engineering, and had practical experience in Inspection of Engineering Materials or Products.
Applications, stating qualifications, experience and date of birth, should be addressed to SECRETARY (S.2.d), Air Ministry, Adastral House, Kingsway, W.C.2. 4312

Engineering Draughtsman (TEMPORARY) REQUIRED for the Directorate of Works in the War Office. Recent Drawing-office experience in the Lay-out of Heavy Oil Engines and Auxiliary Plant, and a general all-round knowledge of Mechanical and Electrical Plant is required. Candidates should preferably be under 35 years of age and should have passed the examination for Associate Membership of the Institution of Mechanical Engineers or its equivalent. Salary between £4 4s. and £5 5s. a week, according to qualifications and experience.
Application form obtainable from the UNDER-SECRETARY OF STATE (C.5), The War Office, London, S.W.1, and to be lodged by 13th July, 1935. 4287

INDIAN ORDNANCE FACTORIES.
The Secretary of State for INDIA invites APPLICATIONS for the POST of ASSISTANT WORKS MANAGER at the Metal and Steel Factory, Ishapore, Bengal. Salary, Rs. 600 a month, plus £25 a month sterling overseas pay, rising by annual increments of Rs. 50 a month to Rs. 800 a month, plus £25. The appointment is non-pensionable, but there is a Provident Fund, subscription to which is compulsory. Free passage to India is granted, and quarters, if available, are provided at a rental not exceeding 10 per cent. of salary. An agreement for five years will be entered into in the first instance.
Candidates must be British subjects and the sons of British subjects. They must be well educated, and should be between the ages of 25 and 35 years. They should have obtained a University Degree or its equivalent, preferably in Metallurgy, and should have had at least five years' experience with a firm of repute dealing with Melting, Casting, Hot and Cold Working (Rolling and Drawing), and Heat Treatment of Non-ferrous Metals. Experience in Press Work, Extrusion, and particularly of Electric Furnace Melting of Non-ferrous Metals, will be an advantage. Candidates should have good ideas of shop organisation and be able to control subordinate staff and labour.
The selected officer will be required to proceed to India about the middle of September next.
Applications should be submitted as soon as possible before the 31st July, on forms to be obtained from THE SECRETARY, Military Department, India Office, London, S.W.1. Envelopes should be marked "Ordnance (Ishapore) Recruitment."
Applications from candidates who do not possess the requisite qualifications cannot be considered.
India Office,
June, 1935. 4319

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The Prospectus gives particulars of the courses leading to the Manchester University Degrees (B.Sc. Tech., M.Sc. Tech., and Ph.D.) and Certificates in the Faculty of Technology, in the following Departments:
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(Professor John Hollingworth, M.A., D.Sc., A.C.G.I., M.I.E.E.)
MUNICIPAL ENGINEERING.
(R. J. Cornish, M.Sc., A.M. Inst. C.E.)
APPLIED CHEMISTRY, including General Chemical Technology, Metallurgy and Assaying, Fermentation Processes (including Brewing), Electro-Chemistry, Photography, Colouring Matters, Foodstuffs, Fuels, and Chemical Engineering.
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(K. G. Fenelon, M.A., Ph.D.)
Prospectus will be forwarded free on application to the REGISTRAR, College of Technology, Manchester, 1. 4185

MANCHESTER MUNICIPAL
COLLEGE OF TECHNOLOGY.
(FACULTY OF TECHNOLOGY IN THE UNIVERSITY OF MANCHESTER.)
APPOINTMENT OF
ASSISTANT LECTURER IN MECHANICAL ENGINEERING.
The Governing Body invites APPLICATIONS for an ASSISTANTSHIP in MECHANICAL ENGINEERING in the College of Technology, with the title and status of Assistant Lecturer in the University of Manchester.
Salary: £300 per annum (subject to any deduction affecting full-time members of the College Staff under the National Economy (Education) Order, 1931).
Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester. The last day for the receipt of applications is TUESDAY, 9th JULY, 1935.
Canvassing, either directly or indirectly, will disqualify a candidate for appointment.
B. MOUAT JONES,
Principal of the College.
4278

The Engineer

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Robert Gordon's Technical COLLEGE, ABERDEEN.
MECHANICAL ENGINEERING DEPARTMENT.
APPLICATIONS are INVITED for the POST of LECTURER. Candidates should be Graduates in Engineering with Works and Teaching Experience or equivalent qualifications. The successful candidate will enter upon duty on the 2nd September or such other date as may be arranged.
Commencing salary, £250 to £300, according to qualifications and experience, rising by £15 annually to £360.
A scheme of co-operation exists between the Technical College and the University of Aberdeen for providing courses leading to the Pass and Honours Degrees of B.Sc. in Engineering. In Evening Classes courses leading to the Ordinary and Higher National Certificates in Mechanical and Automobile Engineering are provided. Candidates should state any qualifications they may possess with special reference to these courses.
Applicants should lodge, on or before 31st July, 16 copies of a letter of application with the undersigned, from whom a statement of duties and further particulars of the appointment may be obtained.
JAMES McKENZIE,
Secretary.
Robert Gordon's Technical College,
Aberdeen, 25th June, 1935. 4316

University of Leeds.
DEPARTMENT OF MINING.
The Council invites APPLICATIONS for the CHAIR of MINING, which will become vacant on the retirement of Professor J. A. S. Ritson, at the end of the present year. Candidates must be qualified Mining Engineers. Salary £1000 a year. Applications will be received on or before Monday, the 8th July, by THE REGISTRAR, The University, Leeds, 2, from whom further particulars may be obtained. 4229

PUBLIC NOTICES.

The Royal Technical College, GLASGOW.
DEPARTMENTS OF ENGINEERING.
CIVIL AND MECHANICAL ENGINEERING AND APPLIED MECHANICS.
Professor: A. L. MELLANBY, D.Sc., M.I.Mech.E.
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COMPLETE COURSES of INSTRUCTION are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.
Composition fee, not exceeding 25 guineas per annum.
SESSION 1935-36 BEGINS on TUESDAY, SEPTEMBER 24th.
Calendar, by post, 3s., and Prospectus, gratis, may be obtained on application to the SECRETARY. 4268

Rivers Mersey and Irwell CATCHMENT BOARD.
DRAUGHTSMAN WANTED, having good general experience of Design and Detailing of Civil Engineering Works. Must be neat, quick, and able to prepare finished drawings from sketches. Preference will be given to man having experience of River Improvement Works, Weirs, Sluices, and Reinforced Concrete Structures. Salary £3 10s. per week. Applications, stating age, full details of experience and when available, and endorsed "Draughtsman" on top left-hand corner of envelope, must be received by the undersigned not later than the 5th of July, 1935.
THE ENGINEER.
14, Crofts Bank-road,
Urmston, near Manchester. 4276

PUBLIC NOTICES.

Borough of Newcastle-under-LYME.
There are in this Borough, which is approximately 13 square miles in area, and has a population of 60,000, EXTENSIVE SITES AVAILABLE for the ERECTION of FACTORIES.
The Borough is in the centre of the Midlands, midway between Birmingham, Manchester and Liverpool, and served by a network of main roads and the London, Midland and Scottish Railway. There are large collieries and ironstone mines, brick and tile works, a natural water supply and ample labour, both male and female, in the district. The population is rapidly growing and houses are being built on an extensive scale. A large Government Aerodrome is being erected at Tern Hill, 14 miles outside the Borough. The area is particularly suitable for Engineering Works.
The Corporation are desirous of having New Industries Established in the Borough and are prepared to offer every facility to those contemplating the establishment of new works.
Further details may be obtained from the Town Clerk's Office.
J. GRIFFITH,
4270 Town Clerk.

Norfolk County Council.
JUBILEE BRIDGE, WIGGENHALL ST. GERMANS.
TENDERS.
The above Council REQUIRES APPLICATIONS from experienced Civil Engineering Contractors desirous of being INVITED to TENDER for the CONSTRUCTION of JUBILEE BRIDGE, Wiggenhall St. Germans, together with the Demolition of the existing Bridge and other ancillary works. The site of the bridge is on the River Great Ouse, at the village of Wiggenhall St. Germans, approximately 6 miles upstream from King's Lynn.
Alternative schemes have been prepared for a Reinforced Concrete Bridge and a Steel Bridge. In each case the design consists of a three-span cantilever type structure, having a central span of 120ft. and two outer spans of 90ft., the total clear overall length between abutments being 300ft. and net width between parapets is 30ft. The River Great Ouse has an average range at Ordinary Spring Tide of 18ft.
Applicants should state for which (or both) scheme they desire to be asked to tender.
The firms selected to tender will be required to make a deposit of Five Guineas for receipt of specification and plans, to be returned by the County Council on receipt of a bona fide Tender.
Names and addresses to be submitted to H. C. Davies, Esq., Clerk of the County Council, The Shirehouse, Norwich, by not later than Wednesday, 10th July, 1935.
S. H. WARREN,
M. Inst. C.E., M.I. Struct. E.,
Chartered Civil Engineer,
County Surveyor.
24th June, 1935. 4300

The Madras and Southern MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for:—
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Fee, ONE GUINEA, WHICH WILL NOT BE RETURNED.
Tenders must be submitted not later than Two o'clock p.m. on TUESDAY, 16th JULY, 1935.
The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.
By Order of the Board,
G. W. V. DE RHE PHILIPE,
4314 Secretary.

West Midlands Joint Electricity AUTHORITY.
IRONBRIDGE GENERATING STATION: BUILDING WORK.
The above-named Authority invite TENDERS for the BUILDING WORK required to complete the existing Turbine and Boiler Houses at the Ironbridge Generating Station, Buildwas, near Ironbridge, Salop, as indicated upon drawings which may be inspected at the offices of the Authority.
Copies of the specification, form of Tender, and bill of quantities may be obtained from Mr. E. F. Hetherington, M.I.E.E., M.I. Mech. E., Chief Engineer and Manager, at the offices of the Authority, on payment of a deposit of £1 1s., which will, after the Authority have come to a decision on the Tenders received, be returned to the tenderer provided he shall have sent in a bona fide Tender, and shall not have withdrawn it.
Tenders must be forwarded in the envelope provided so as to reach the undersigned not later than Noon on Wednesday, the 17th July, 1935.
The Authority do not bind themselves to accept the lowest or any Tender.
H. F. CARPENTER,
Clerk.
22nd June, 1935.
Phœnix Buildings,
Dudley-road, Wolverhampton. 4280

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The Engineer

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Letters relating to the Advertisement and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters are to be addressed to the Editor of THE ENGINEER.

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This Directory, which is published in the interests of advertisers in THE ENGINEER, may be obtained free of charge on application to the Publisher.

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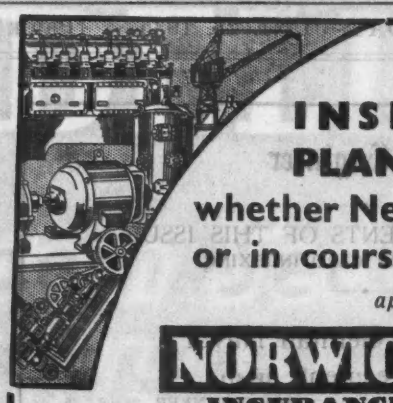

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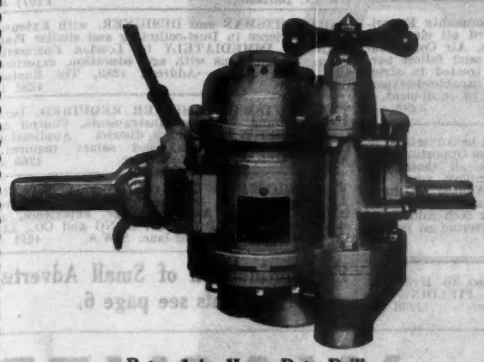

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Your private office— *is it really comfortable?*

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All this, G. V. D. lighting will do for you, without necessarily increasing current and lamp costs; in fact, the result very often is the reverse, SUBSTANTIAL ECONOMIES being effected.

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Please ask for a representative to call, or visit our Showrooms for demonstrations. Alternatively, please apply for literature.

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ED 2

is Post Free.

Price of any particular size of engine up to 1000 b.h.p. will be sent without obligation.

BRUSH ELECTRICAL ENGINEERING LOUGHBOROUGH · ENGLAND

2-9 B

PUBLIC NOTICES.

Stockport Corporation Water-Works.
GOYT VALLEY SUPPLY.
CONTRACT E—HIGH-LANE RESERVOIR.

The Waterworks Committee invite TENDERS for the CONSTRUCTION of a COVERED CONCRETE SERVICE RESERVOIR, to be situated near Carr Brow, High-lane, at a distance of about 1¼ miles from Disley Station on the London, Midland and Scottish Railway, and comprising Excavation, Forming Embankment, Concrete, Plain and Reinforced, Fixing of Ironwork, &c.

Drawings may be seen and specification and form of Tender obtained on application to G. H. Hill and Sons (Manchester), Civil Engineers, 40, Kennedy-street, Manchester, upon receipt of a cheque for THREE GUINEAS, which sum will be returned to the applicant, provided that he shall have sent in a bona fide Tender, and shall have not withdrawn the same, and shall have returned the documents and drawings sent to him.

Copies of the drawings may be obtained from the Engineers on payment of TWO GUINEAS, which sum will not be returned.

Separate cheques should be sent made payable to G. H. Hill and Sons (Manchester).

Sealed Tenders, endorsed "Goyt Valley Supply, Contract 'E,'" and addressed to the Chairman of the Waterworks Committee, must be delivered at the Waterworks Offices, Town Hall, Stockport, not later than 10th July, 1935.

The Corporation do not bind themselves to accept the lowest or any Tender.

FRANK KNOWLES,
Town Clerk.

Town Hall,
Stockport, June, 1935. 4277

The Civil Engineers Appointments BOARD, 8, Princes-street, Westminster, S.W.1, acting under annual licence from the London County Council, INVITES INQUIRIES FROM EMPLOYERS seeking the services of professional engineers either as Assistants or in more responsible positions. All those whose names are accepted for entry upon the Board's Register for employment possess qualifications which have been attested by means of scientific examinations, practical training and experience. 3845 I

SITUATIONS OPEN.

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TO ADVERTISERS UNDER BOX NUMBERS IN THIS CLASSIFICATION.

For the benefit of applicants, the Proprietors are prepared to insert brief notices that vacancies are filled, upon receipt of notifications from the Advertisers. These notices (limited to one line) will be free of charge, and co-operation is asked for.

WANTED, a MILL MANAGER, with Experience of CONTINUOUS SHEET BAR AND BILLET MILL PRACTICE. Applicants must state age, salary required, and particulars of experience. If application proves satisfactory in other respects, references will be required.—Address, 4274, The Engineer Office. 4274 A

WANTED, ASSISTANT SUPERINTENDENT for Machine Shop containing 100/110 High-class Modern Machine Tools, comprising chucking and bar automatics, grinders, gang drilling machines, &c. Applicant must have expert knowledge of mass production of medium-size cast iron and steel component parts for electromotors, calling for high precision and interchangeability of parts and be experienced in the handling of skilled, semi-skilled, and unskilled labour working on a piecework basis. Must be capable of planning programmes against minimum costs of production. Good salary to suitable man. State age, wage, and full particulars.—Address, 4302, The Engineer Office. 4302 A

WANTED, ASSISTANT SUPERINTENDENT in Charge of Production, capable of arranging from order book, quantity production of small electromotors, fans, and domestic apparatus. Good opening for man with sound experience in planning production to meet firm delivery dates. Good salary and prospects to really live man. State age and full particulars of experience.—Address, 4301, The Engineer Office. 4301 A

WANTED, ENGINEER, for Care of Ruston and Hornsby Oil Engines; knowledge of Quarry Machinery essential.—Address, with references and wages required, 4286, The Engineer Office. 4286 A

WANTED, Experienced MAN as SUPERINTENDENT of Factory producing High-class Electrical Motors. Only men with high-class modern experience in mass production of electrical motors with modern tools and appliances need apply. Ability to control male and female labour working on a piecework basis essential.—Address, stating age, experience, and salary required, 4303, The Engineer Office. 4303 A

WANTED, FOUNDRY and PATTERN SHOP SUPERINTENDENT for up-to-date Mechanised Foundry employing 300/350 men. Must be experienced in making of patterns and production of castings from drawings, the use of modern power-operated moulding machines engaged upon quantity production of castings, and have previously controlled skilled and semi-skilled labour working on piecework basis. State age, experience, and salary required.—Address, 4304, The Engineer Office. 4304 A

A RARE OPPORTUNITY—LONDON AREA.—A GENTLEMAN, who is really well known amongst architects and consulting engineers and with a reputation for securing big work, can ADD ANNUALLY FOUR FIGURES to his INCOME. The line is a speciality in positively first-class floors for heavy traffic work, such as railways, factories, garages, dairies, aerodromes, abattoirs, &c. Proved over a long period throughout England and abroad. Please not reply without the above connection. State age and experience. Letters treated in strictest confidence.—Address, P1074, The Engineer Office. P1074 A

ASSISTANT CIVIL ENGINEER REQUIRED for South American Waterworks. Passage paid.—Candidates should write, stating age, and experience, to A. W., c.o. Streets, 6, Gracechurch-street, London, E.C.3. 4294 A

ENGINEER REPRESENTATIVE, with Intimate knowledge of Laundry Engineering, with view to introducing speciality effecting economies in steam power.—H. and T. DANKS (Netherton), Ltd., Netherton, Dudley. 4290 A

ERECTORS with First-class Experience of Installation of Baths Filtration Plant and Water-Softening Plant REQUIRED AT ONCE by leading Water Purification Company.—Address, giving fullest particulars of previous experience, age, and references, 4271, The Engineer Office. 4271 A

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ENGINEERING DRAUGHTSMAN, £150 per Annum. Able to Make and Plot Surveys, Prepare Plans, &c. Must have general engineering experience. Applications, stating age, qualifications, and any other relevant information, and enclosing copies of recent testimonials, to reach the undersigned not later than 12th July, 1935.
N. A. MATHESON,
Harbour Engineer,
4284 A Customhouse Quay, Greenock.

EXPERIENCED ASSISTANT COST CLERK, Able to read drawings, by General and Brewers' Engineering Firm in West of England.—Address, stating age, experience, and salary required, 4282, The Engineer Office. 4282 A

JUNIOR ENGINEERING ASSISTANT. Experience in Surveying and General Civil Engineering, preferably Harbour Work. Temporary appointment for three years. State salary required.—Apply, A. E. BUTTERFIELD, M. Inst. C.E., Engineer, Humber Conservancy Board, Hull. 4309 A

MECHANICAL ENGINEER, Age 25 to 40, with extensive experience in the Design and Lay-out of Special and Standard Manufacturing Equipment, REQUIRED by large Engineering Firm in the Midlands. Only applicants with good "time sense" and proved ability to take full responsibility without supervision will be considered.—Address, with full details of age, experience, when free, and salary required, 4270, The Engineer Office. 4270 A

SITUATIONS OPEN.

MACHINE TOOLS ENGINEER, with Thorough knowledge of above trade and with full commercial experience, REQUIRED AT ONCE. Knowledge of German language necessary. State full particulars of previous occupation, age, and salary required.—Address, 4295, The Engineer Office. 4295 A

SALES ENGINEER. Must be Thoroughly Experienced and have successful record all classes of Drying Equipment, Conveyor Ovens, Air Conditioning, &c. To receive consideration, send fullest particulars in first instance. Replies treated in strict confidence. Also DRAUGHTSMAN, capable designer, with wide experience in this range of equipment.—Address, 4296, The Engineer Office. 4296 A

THE Post You are Seeking May Not be Advertised in this Column, but do not Lose the Opportunity of Bringing Your Requirements before all those who would be Interested and could employ you. An Advertisement in the "Situations Wanted" Column would be seen by all Leading Engineering Concerns, for a cost of Four Lines 4s.; 1s. for each Additional Line. There is no better way of covering so large a field for such a small charge.

WANTED, DRAUGHTSMAN, Used to Hydraulic Machine Tool Work.—Apply, FIELDING and PLATT, Ltd., Atlas Works, Gloucester. 4266 A

SITUATIONS OPEN.

WANTED, MECHANICAL DRAUGHTSMAN, for Chemical Plant and Furnace Work, near London.—Address, 4273, The Engineer Office. 4273 A

CHIEF DRAUGHTSMAN WANTED, Used to Modern Rolling Mill Design. One having had field experience preferred. Applications, in writing, stating age, experience, and salary required.—WELLMAN SMITH OWEN, Darlaston. P1071 A

DRAUGHTSMAN and DESIGNER, with Extensive experience in Dust-collecting and similar Plant, WANTED IMMEDIATELY by London Engineering Firm. Applications with age, education, experience, and fullest details.—Address, 4283, The Engineer Office. 4283 A

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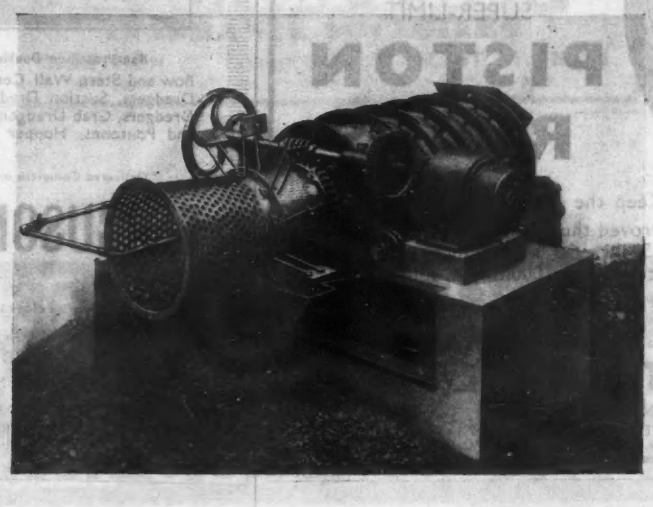
DRAUGHTSMEN REQUIRED, must have had experience in Detailing Steelwork for Steel-framed Buildings, &c.—State age, experience, and salary required to DORMAN, LONG and CO., Ltd., Cringle-street, Nine Elms-lane, S.W.8. 4291 A

For continuation of Small Advertisements see page 6.

THIS GRAVEL WASHER GRADES AGGREGATES



THE "Peebles" Patent sand and gravel washing machine illustrated above is an electrically operated unit of very efficient design, which washes and automatically grades mixed aggregates for concrete making.

The sand and gravel are separated immediately the aggregate is fed into the machine, which ensures thorough washing of every particle, absence of clogging and accurate grading.

The wash water is arranged on the contra-flow system, which ensures efficient operation and remarkably low consumption.

The machine illustrated is capable of washing and separating 8/10 tons of mixed aggregates per hour, but washers suitable for larger quantities can also be supplied, with screens to suit any size and number of grades desired.

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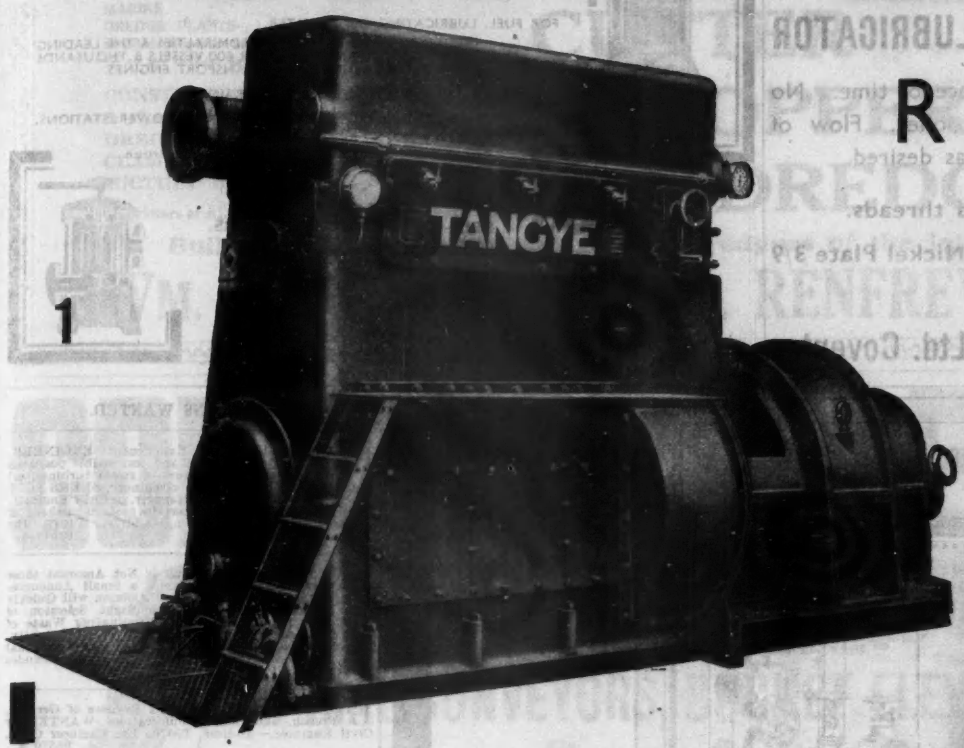
TANGYE

RANGE OF VERTICAL DIESEL ENGINES

"VH" AND "VC"

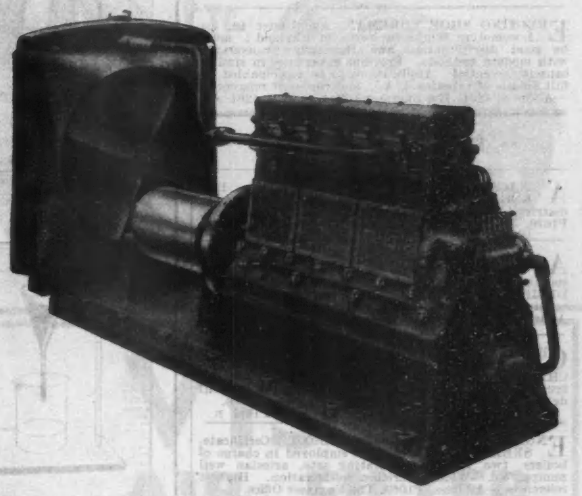
1



1 VH TYPE **VERTICAL DIESEL ENGINE** FOR POWERS UP TO 530 B.H.P., IN SIZES FROM 1 — 8 CYLINDERS.

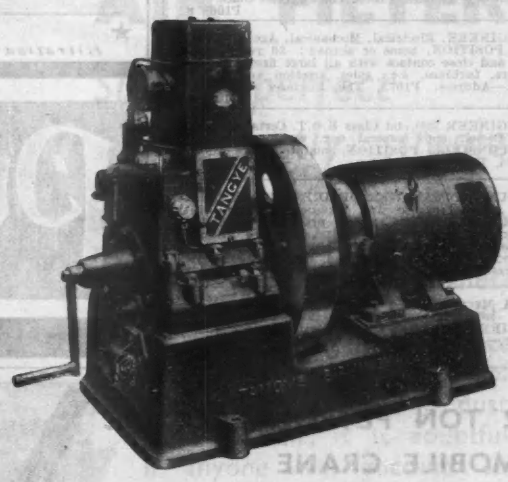
These engines have many unique features. They are CONTROLLED entirely by ONE lever and are totally enclosed, SILENT and VIBRATIONLESS RUNNING.

2



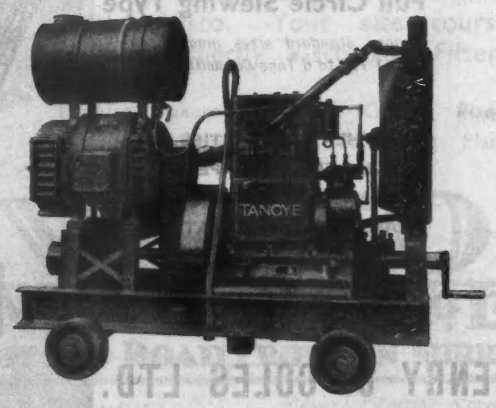
2 VC This is a Six-Cylinder **SELF-CONTAINED ENGINE** AND IS TYPICAL OF THE RANGE. THE ENGINE ILLUSTRATED IS IN DAILY SERVICE ON THE GREAT BEAR LAKE, CANADA, ON THE FRINGE OF THE ARCTIC CIRCLE. REPEAT ORDERS FOR SIMILAR SETS HAVE RECENTLY BEEN RECEIVED.

3



3 VC ANOTHER EXAMPLE OF THIS RANGE OF **VERTICAL ENGINES.** These are for powers of from 8 to 72 B.H.P., and from 1 to 6 cylinders. The set illustrated is a single cylinder, direct coupled to a generator and mounted on an underlying baseplate. The range is for outputs up to 40-kW A.C. or D.C.

4



4 VC THIS ILLUSTRATION SHOWS A **TWO-CYLINDER ENGINE,** BUILT INTO A PORTABLE WELDING SET. THERE ARE A LARGE NUMBER OF DRIVES FOR WHICH THIS TYPE OF ENGINE IS SUITABLE, BEING COMPACT, VIBRATIONLESS AND TROUBLE FREE.

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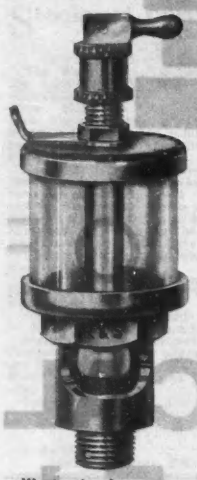

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FOR FUEL, LUBRICATING OIL & WATER.

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USED IN LARGEST OIL ENGINED POWER STATIONS.

Patented throughout the World. All British.

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for :—ULTRA FINE STRAINING, LOW PRESSURE LOSS, etc.

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DRAUGHTSMAN REQUIRED IMMEDIATELY for well-known London Firm of Engineers specialising in High-speed Purifying Machinery. Previous knowledge not necessary; must be experienced in the Preparation of General Arrangements and Detailed Working Drawings. Age 25-30.—Address, with full particulars of training, experience, salary required, and when at liberty, 4230, The Engineer Office. 4230 A

LIFT DRAUGHTSMAN, with Experience, REQUIRED; used to Lay-outs, &c.—Apply in writing to J. and E. HALL, Ltd., Dartford, Kent, stating age, experience, and salary expected. 4299 A

DRAUGHTSMAN REQUIRED. Knowledge of Furnace Work and Steel Work an advantage.—Address, 4307, The Engineer Office. 4307 A

ERECTING SHOP FOREMAN, Age Under 40, for Locomotive Works in North of England; must be good disciplinarian and thoroughly conversant with modern methods. Previous experience in similar capacity essential. Applications to be accompanied by full details of experience, &c., and copies of references.—Address, 4264, The Engineer Office. 4264 A

SITUATIONS WANTED.

A MACHINERY SALESMAN OPEN for RE-ENGAGEMENT. Well connected, London district. Power plant, &c. Car driver.—Address, P1079, The Engineer Office. P1079 B

A M.I. MECH. E. (31), Oil Engine Specialist, Wide experience overseas as manufacturers' representative, also in charge London experimental plant, DESIRES RESPONSIBLE POST at home or abroad requiring ability and energy, sales or technical.—Address, P1078, The Engineer Office. P1078 B

CHARTERED MECHANICAL ENGINEER, Experienced plant and production, DESIRES CHANGE, home or abroad. Progressive position of trust required; 22 years' engineering experience all departments.—Address, P1061, The Engineer Office. P1061 B

ENGINEER (27), 2nd Class B.O.T. Certificate, SEEKS POSITION. Last employed in charge of boilers, two 150 kW generating sets, artesian well pumps, &c. Wide experience refrigeration. Highest references.—Address, P1059, The Engineer Office. P1059 B

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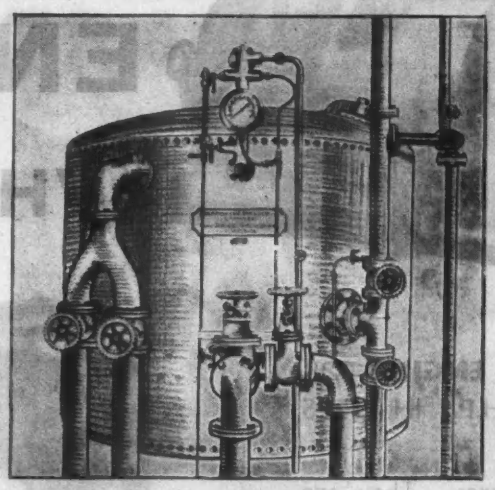
FOUNDRY MANAGER DESIRES APPOINTMENT. Accustomed to full executive responsibility, estimating, costing, sales; practical foundryman, expert in machine, loam, dry-sand, and greensand moulding of high-class engineers' castings; fully experienced with ferrous and non-ferrous alloys.—Address, P1080, The Engineer Office. P1080 B

G. I. MECH. E. (24), Several Years' Experience of workshop methods in small I.C. engines, DESIRES POSITION with opportunities for advancement.—Address, P1076, The Engineer Office. P1076 B



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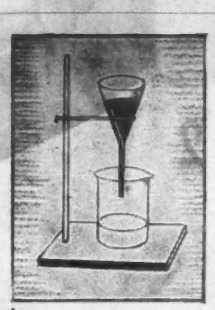

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FULLY Qualified and Experienced ENGINEER, having held important and responsible positions in the design and manufacture of steam turbines, oil engines, and other high-class machinery, SEEKS POST as General Manager, Works Manager, or Chief Engineer. Excellent organiser and expert in modern methods of management and production.—Address, P1047, The Engineer Office. P1047 B

IF the Man You are Seeking is Not Amongst those Advertising in this Column, a Small Announcement in the "Situations Open" Column will Quickly and Economically Produce the Right Selection of Applicants, at the same time Eliminating Waste of Effort, Waste of Time, and Waste of Opportunity. The charge is Four Lines or under 4s., each Additional Line 1s.; Box Numbers 6d. extra, which includes despatch of all replies.

LITERARY WORK, Including Reviews of German, French, and English publications, WANTED by Civil Engineer.—Address, P5570, The Engineer Office. P5570 B

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PRODUCTION ENGINEER, with wide Experience in economical increasing of production and getting the best out of plant not in its first youth, SEEKS POSITION where this experience could be usefully employed. Both light and heavy work.—Address, 4285, The Engineer Office. 4285 B

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For continuation of Small Advertisements see page 46.

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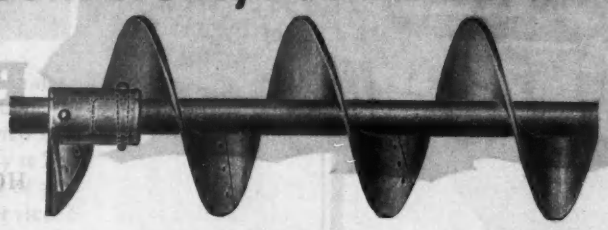

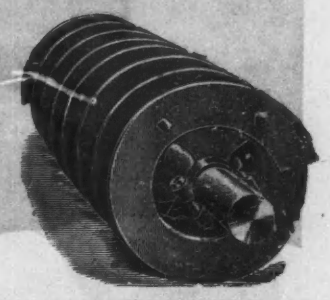

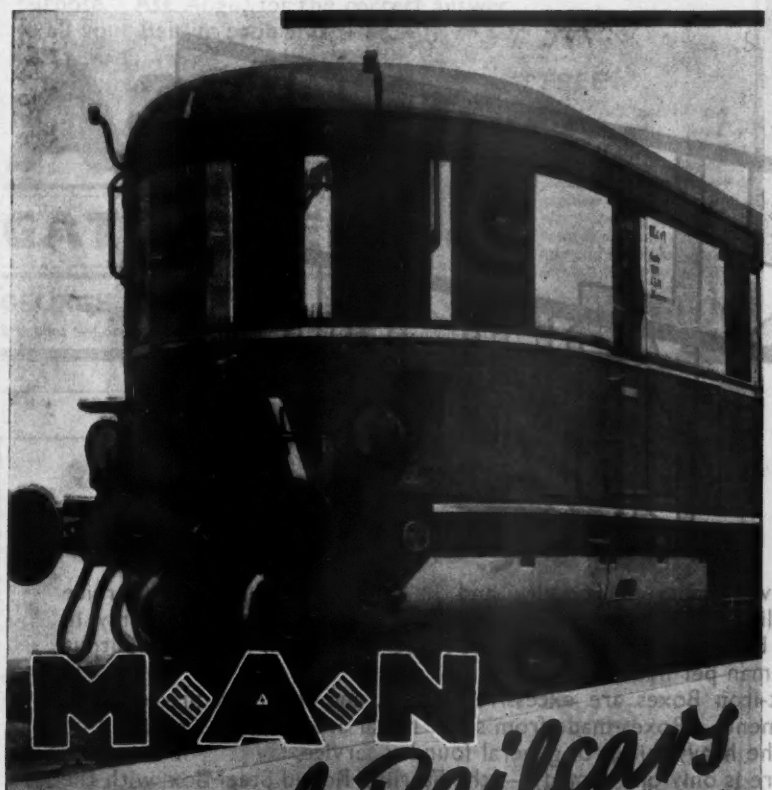

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Ireland: L. J. Warnants, Dublin C 5, 202, Pearse Street.

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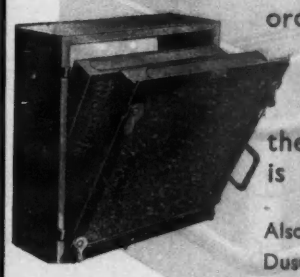

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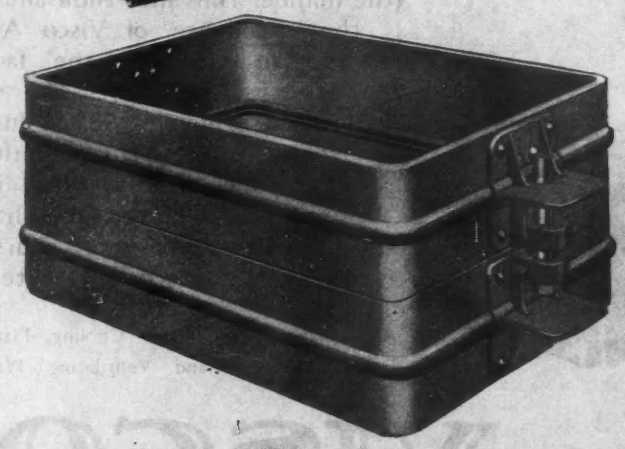

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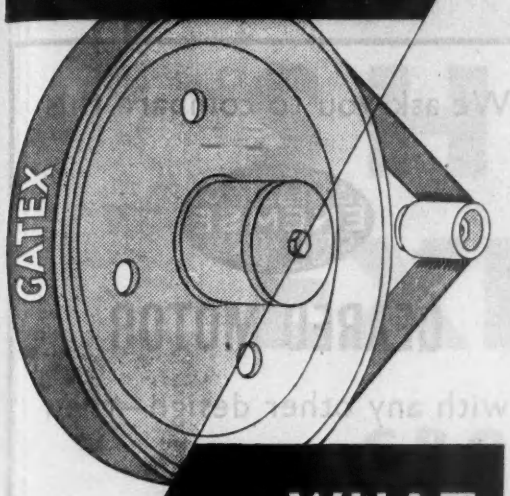

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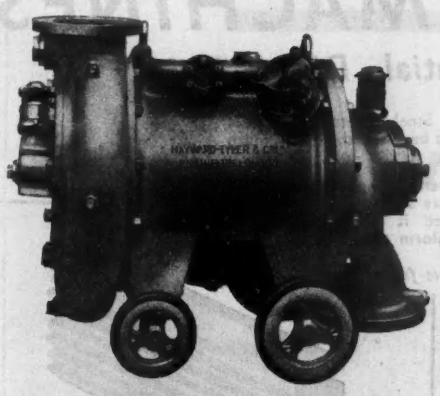

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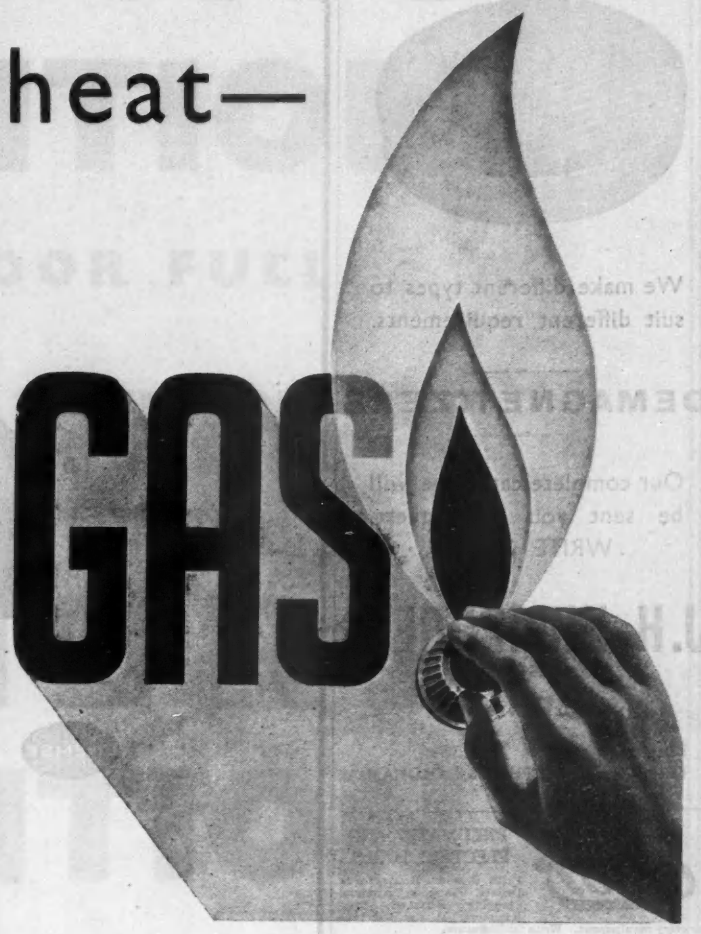

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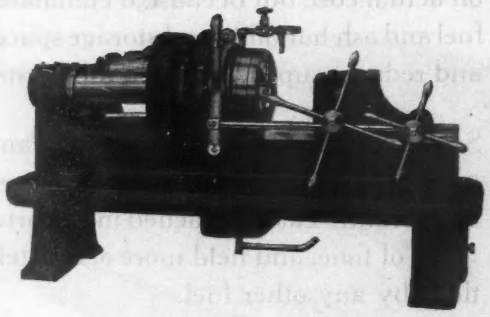

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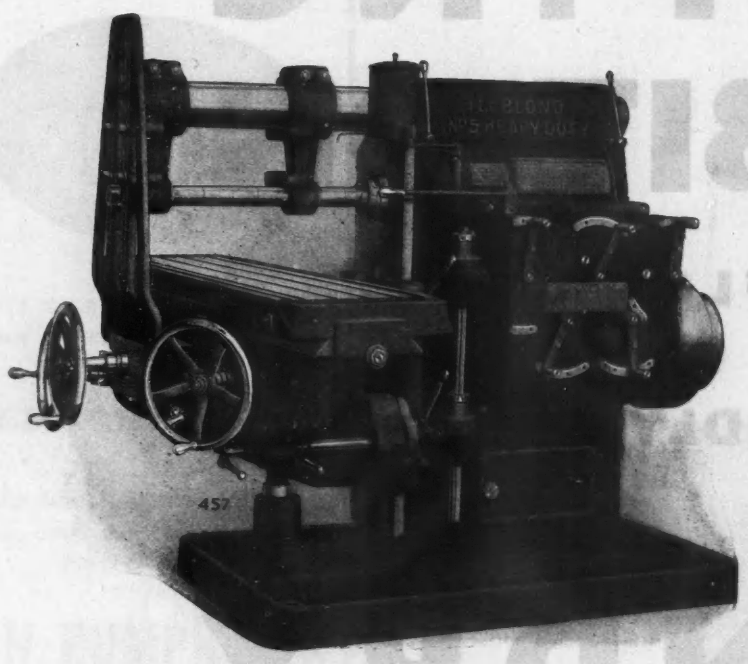

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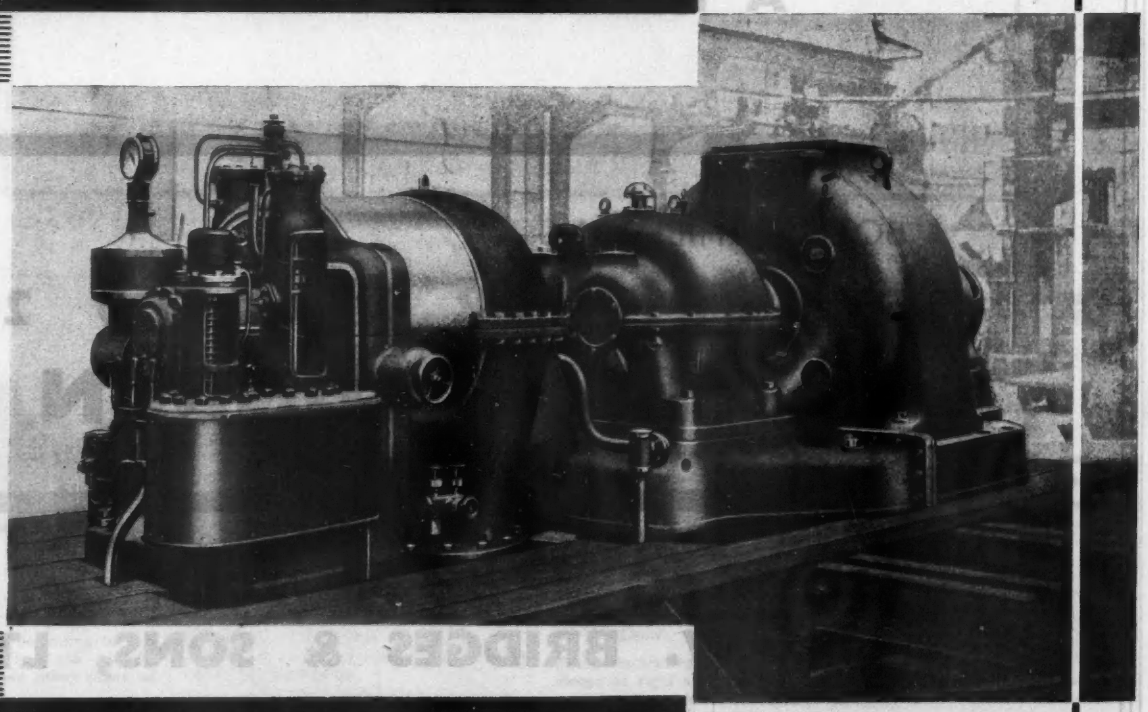

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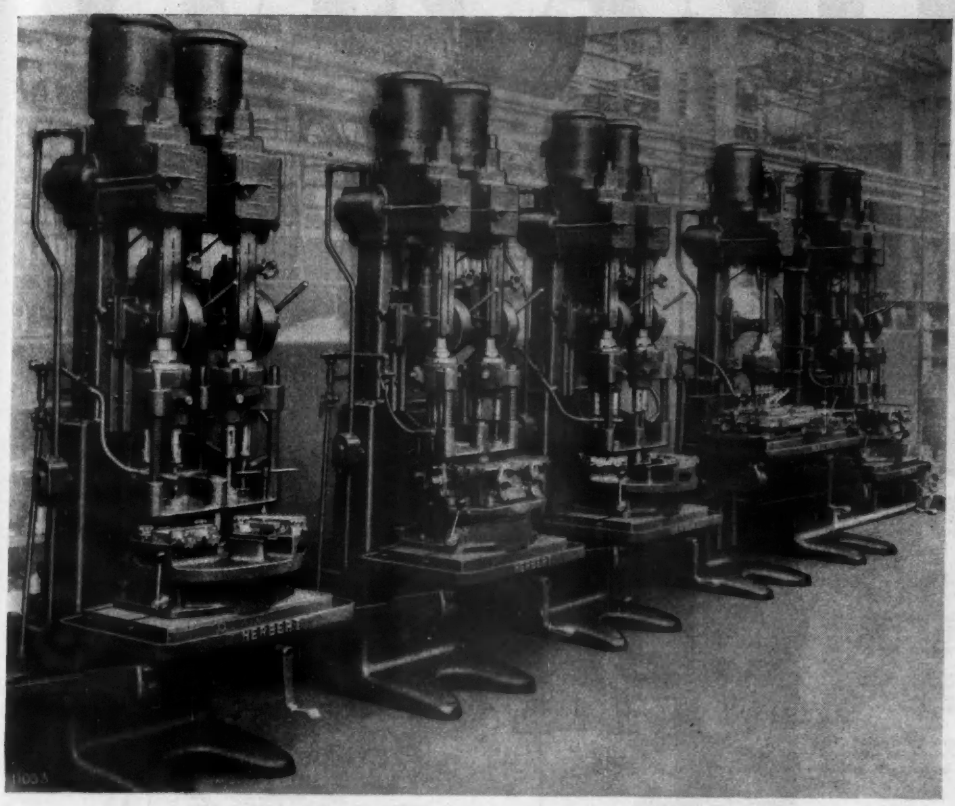

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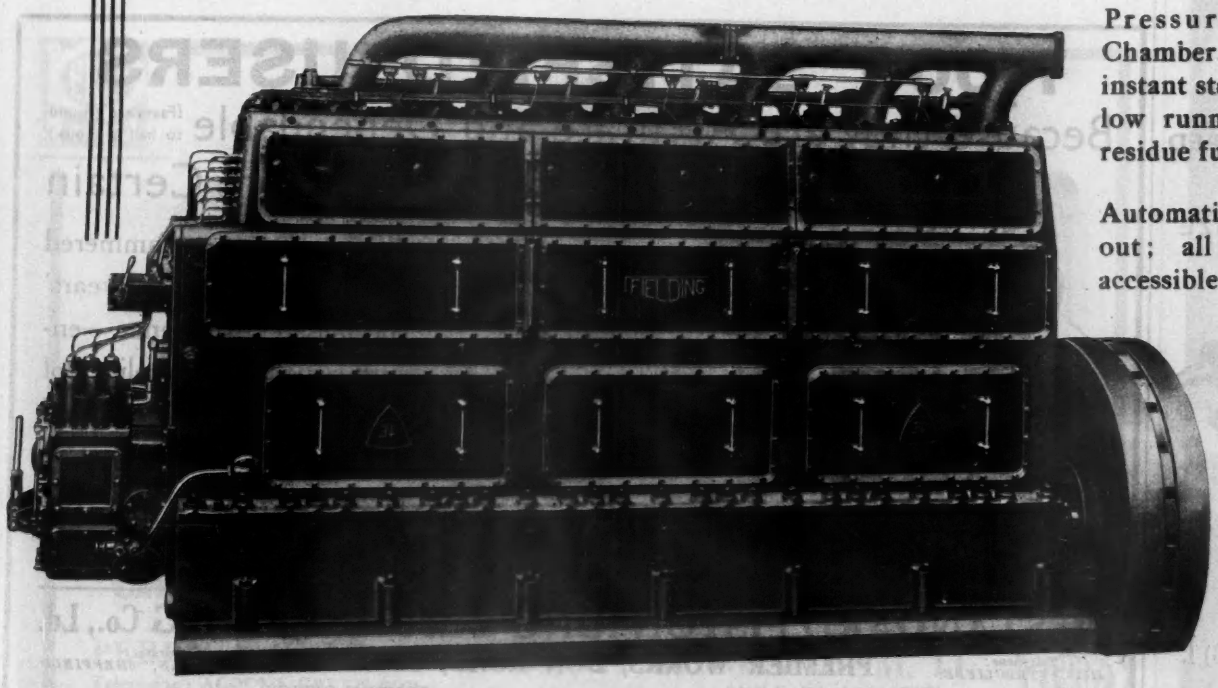

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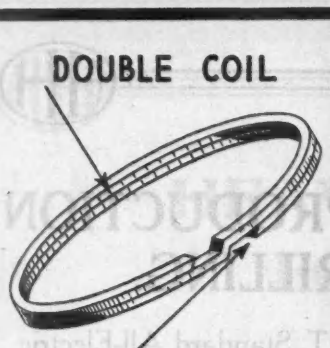

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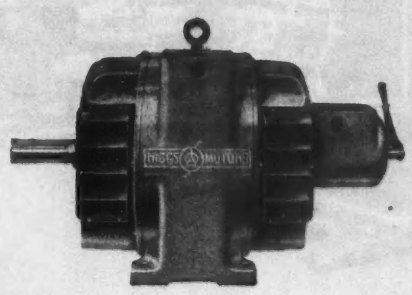

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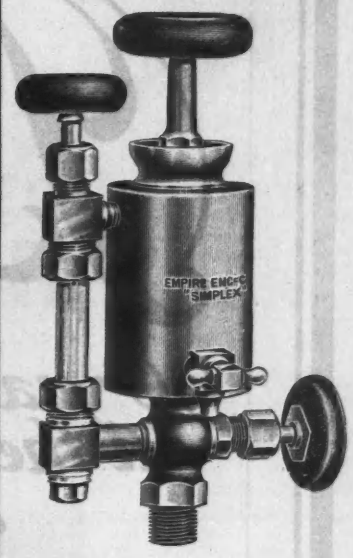

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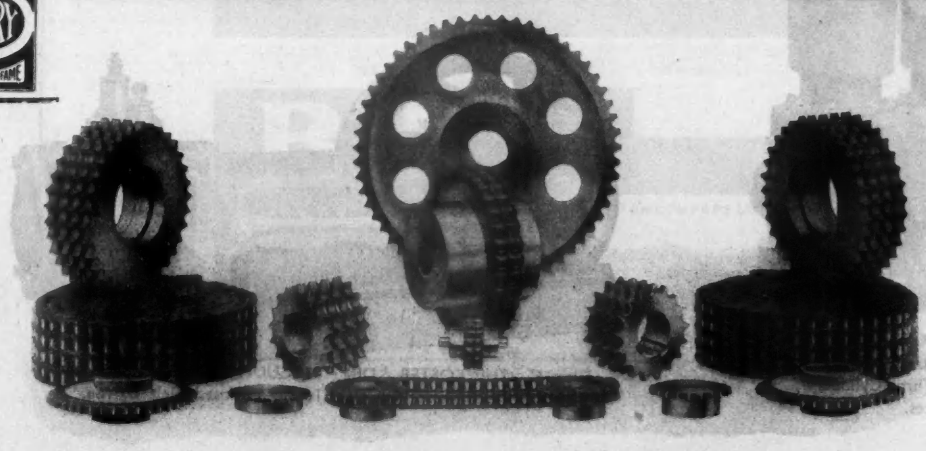

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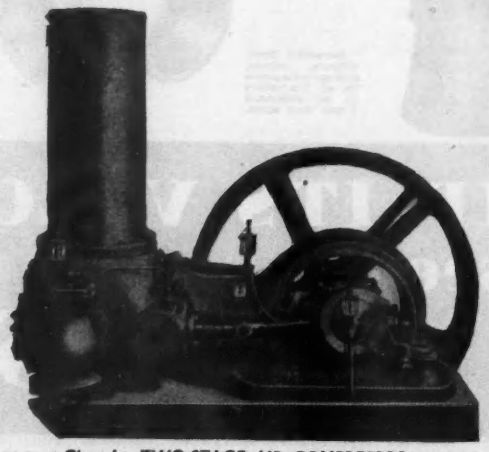

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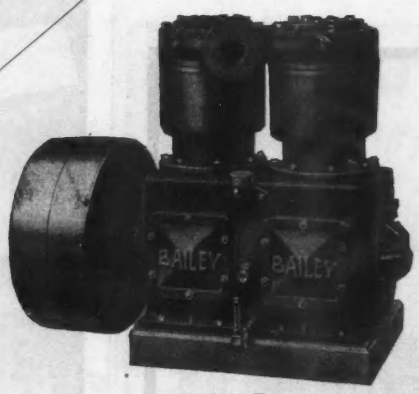

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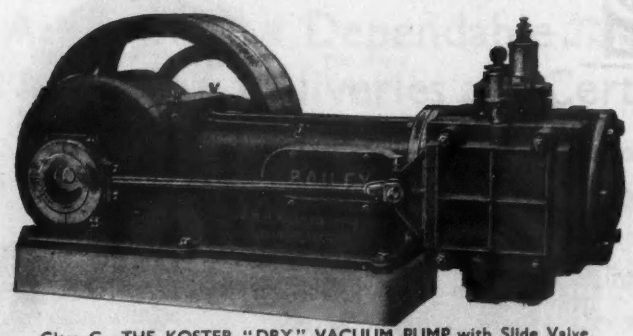

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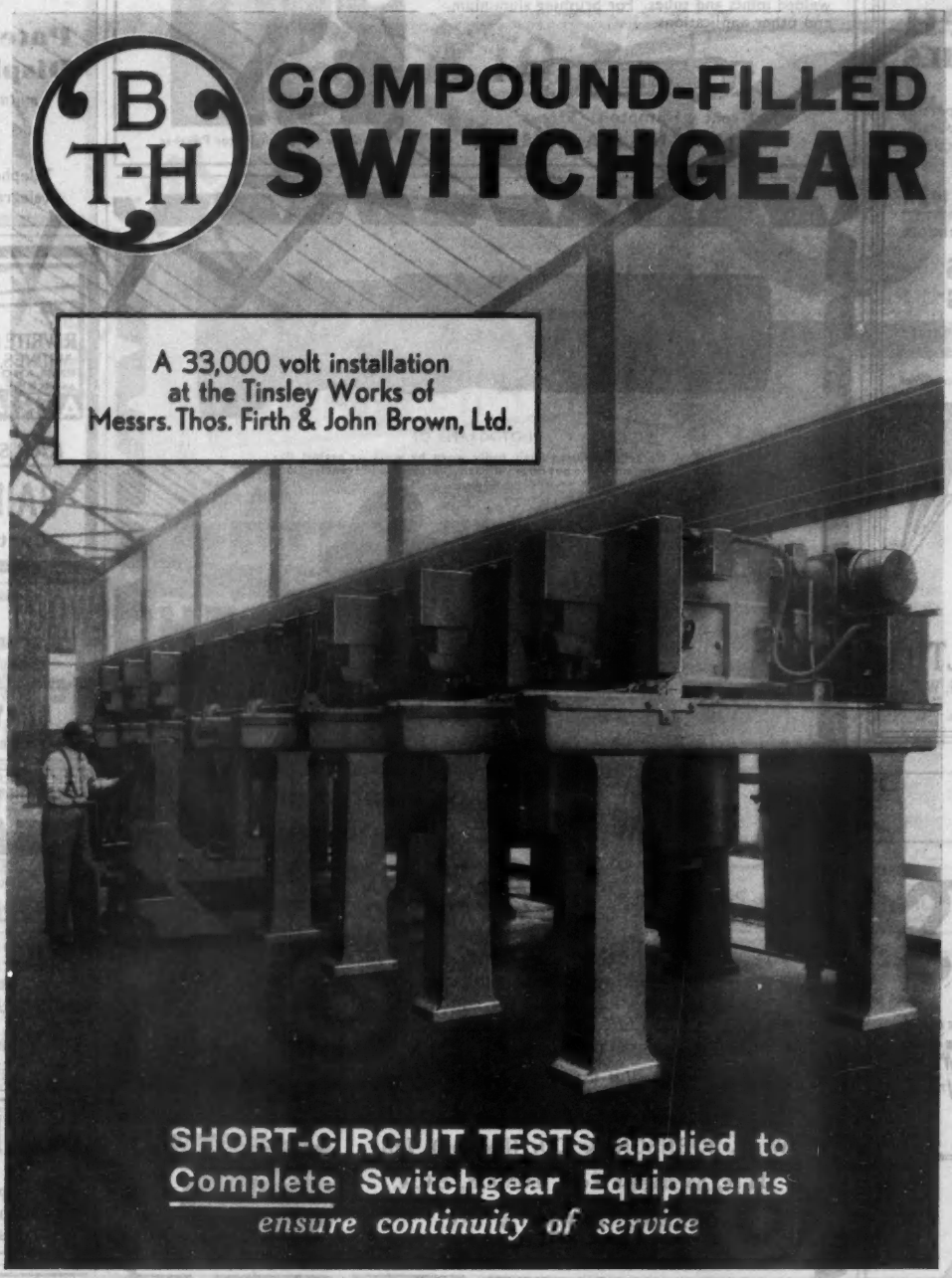

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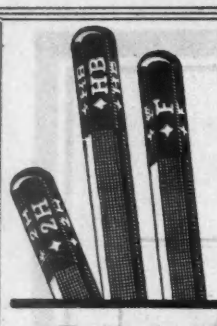

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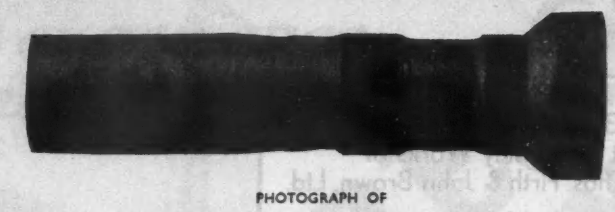

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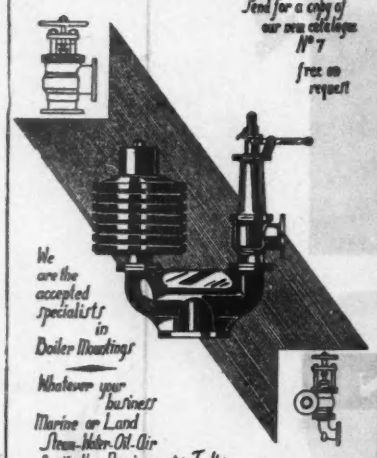

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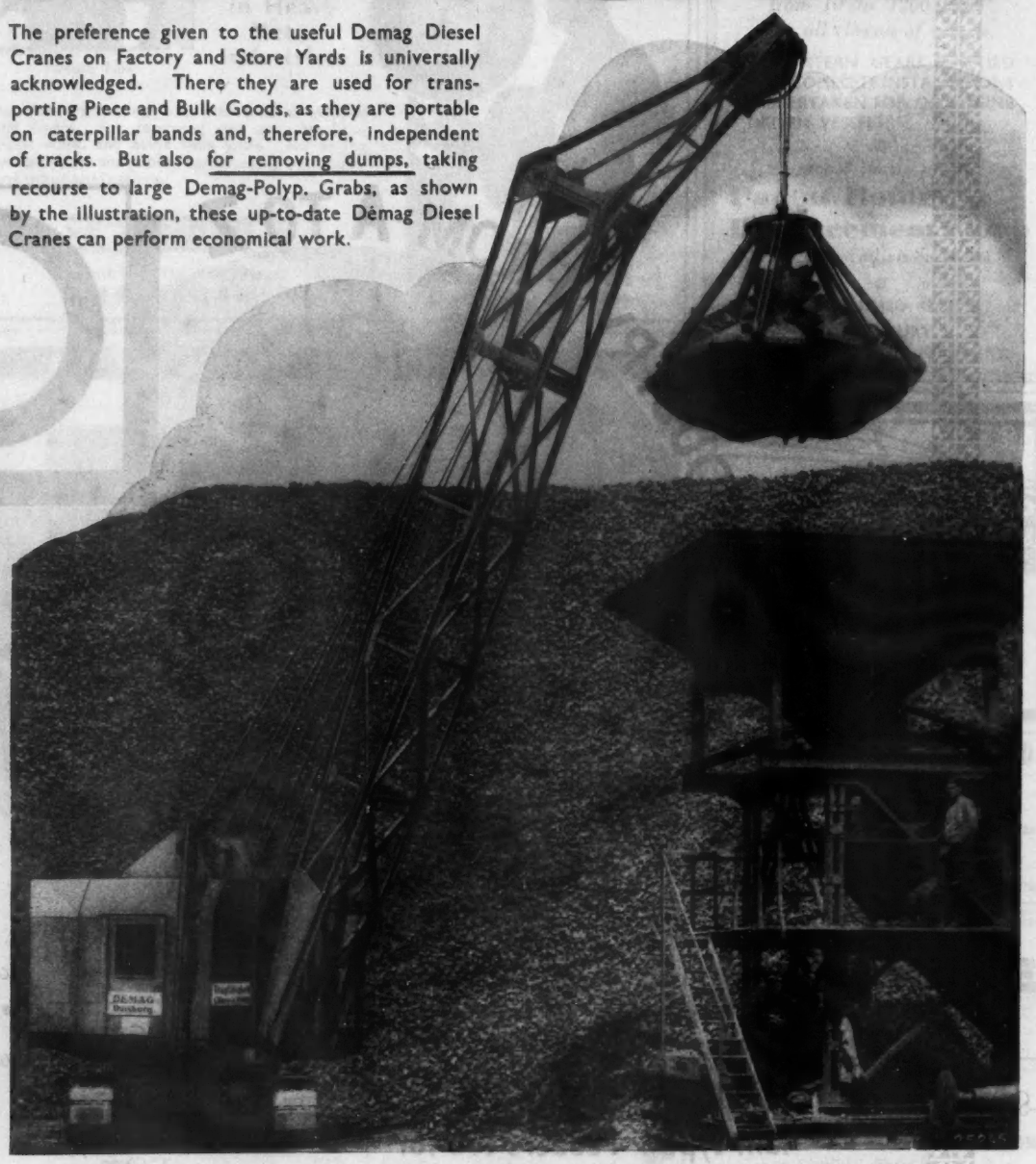

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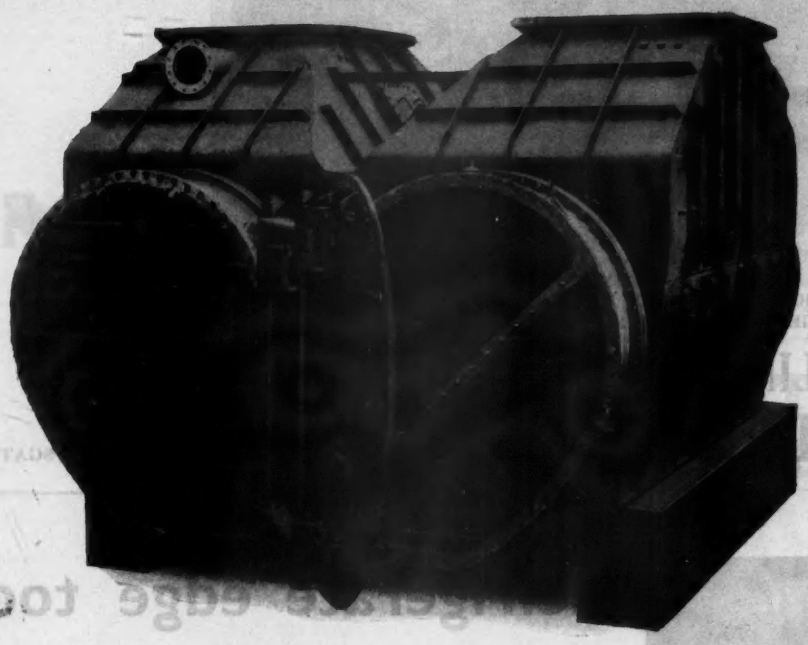

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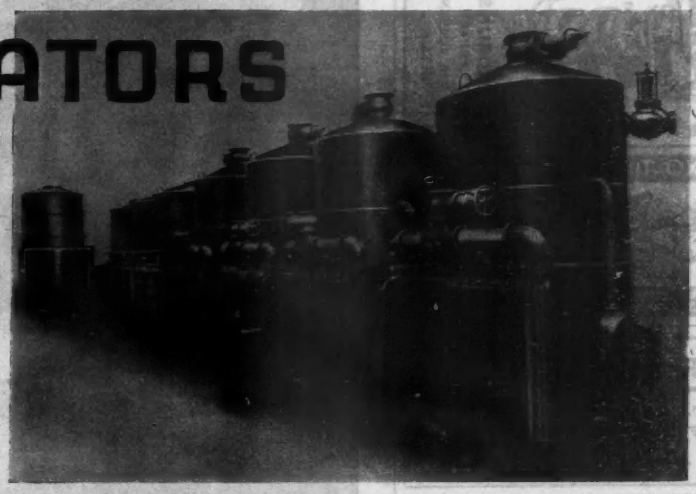

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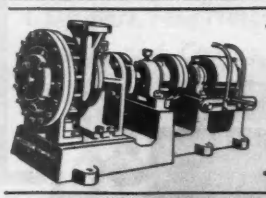

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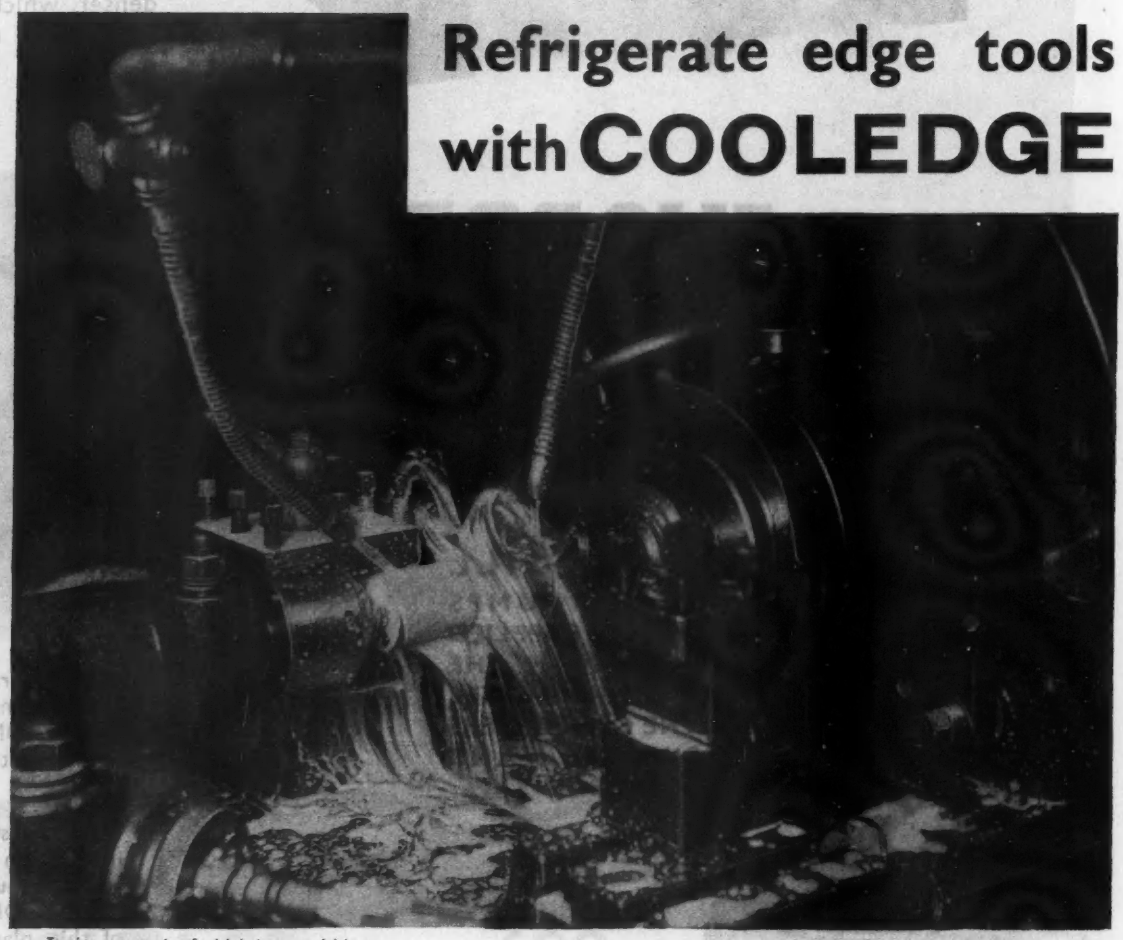

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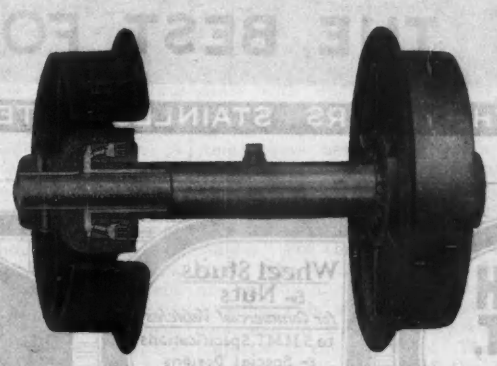

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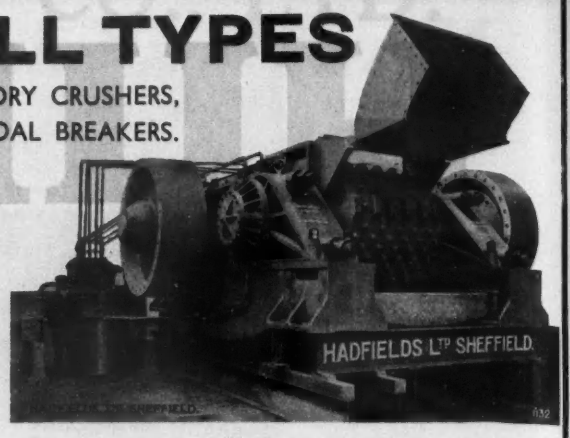

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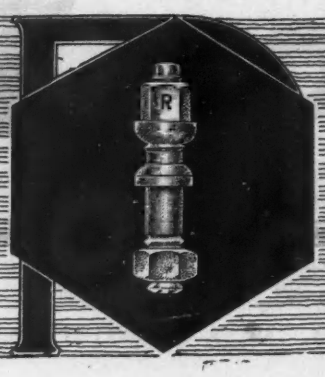

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The Welwyn Garden City Railway Accident.

As anticipated herein a week ago, the Ministry of Transport inquiry into this serious collision of June 15th was conducted by Colonel Mount. It will be remembered that the second portion of the 10.45 p.m. express from King's Cross to Newcastle, which left eight minutes after the first portion, was caught up and run into by a parcels-passenger train, which left King's Cross at 10.58. Thirteen passengers and the guard of the Newcastle train were killed. It is believed that all these were riding in the last vehicle of that train, which was completely destroyed. All the evidence as to the movements of the parcels train was given in private, and it is not yet, therefore, definitely known what was the cause of the collision. The evidence given in public confirms all the facts related in our leading article of June 21st. All the eleven coaches of the 10.53 train had steel underframes, buckeye couplers, and teak bodies. There was very little damage to the first nine vehicles; all the damage was confined to the last two. As said above, the last coach—a brake third—was completely wrecked and the collision separated it from the tenth coach and tore away both its bogies. The buckeye coupling between the ninth and tenth held and the last named turned on its side, but all the passengers left by the doorways, which were nearly facing the sky. As we anticipated last week, the first three vehicles on the parcels train were of modern construction, with steel underframes and buckeye couplers. The fourth coach was not of modern construction and as it had a screw coupling, the buckeye on the rear of the third coach could not be used. The fourth therefore telescoped into the third, and it was in the latter that most of the injuries occurred. The fifth and sixth were of the same construction as the fourth—all were vans, built in 1900 and 1902, and gas lighted. The seventh had a steel underframe, but as it was a compartment and not a corridor coach it had no Pullman vestibule nor buckeye coupling. The last three vehicles were brake vans and the last two of them were undamaged. To sum up, those vehicles which had buckeye couplings remained coupled; those with screw couplings were separated and were free to move in any direction.

A Proposed Severn Road Bridge.

THE possibility of building a bridge across the Severn, some distance below Gloucester, has recently been the subject of correspondence between the Gloucestershire County Council and the Ministry of Transport. Mr. Hore-Belisha has now informed the Council that he is in a position to promise a 75 per cent. grant from the Road Fund towards the cost of a preliminary survey and report. The object of the survey is not to examine any particular site, but to make a general study of the problem from a geographical and engineering point of view. It has been pointed out that the construction of such a bridge would shorten very considerably the distance by road between London and South Wales, besides facilitating communication between the counties on opposite sides of the river. There is at present no road bridge below Gloucester, and traffic between Bristol and Cardiff must either use the ferry or make a long detour. The question of bridging the Severn at a point in the lower reaches of the river is a very old one, and was discussed at a conference of local authorities in 1923, but without result. Latterly, the project has been revived and various sites have been suggested, including one from Beachley, near Chepstow, to Aust, a site about three miles above the Severn Tunnel.

Steel Trade Prosperity.

THE Minister for the Department of Overseas Trade (Lieut.-Colonel J. Colville) spoke in an encouraging vein at the London Iron and Steel Exchange luncheon on June 25th at the Hotel Victoria. He addressed an audience representing most sections of the trade and, referring to the many adjustments in the home market which would be a necessary consequence of the great changes which had occurred of late, he pleaded for patience. In the recovery which had taken place co-operation between the different sections of the industry and between the industry and the Government had played an important part. He instanced the international industrial agreement which had just been negotiated, and said that confidence was reviving in the Continental iron and steel markets, and in this country optimism prevailed. He reminded his hearers that the May steel output had reached a total of 853,300 tons, the highest point since October, 1929. If the May figures could be maintained it would give the industry an annual output of over 10,000,000 tons, a record which had never yet been achieved by the industry in one year. He could see no reason why that rate of output should not be continued and that record established. Turning to the export trade, he said that the exports had increased between January and May by 15 per cent. over the corresponding period of last year, and of the increase of 70,000 tons for the same period in the exports of iron and steel-producing countries three-quarters had been secured by British steel makers. Lord Greenwood, the Chairman of the Exchange, when introducing Colonel Colville, urged the necessity of a continuance of the present Government, for otherwise the progress made in the iron and steel and scores of allied industries would be checked. All should see to it that the continuance of a policy which had brought them out of the depths of adversity and within sight of the horizon of a reasonable prosperity was assured.

An Ordnance Air Survey.

IN a Journal note of August 31st, 1934, we referred to the possibilities of revising Ordnance Survey maps by an aerial survey. We are now given to understand that the Ordnance Survey has entrusted to Aerofilms, Ltd., of Bush House, London, the task of taking air photographs of an area of about 260,000 acres in the Midlands and of enlarging and rectifying them to the scale appropriate to the making of maps of 25in. to the mile. The photographs in this form will be handed over to the Ordnance Survey, and, with the aid of ground survey control, further rectification will be undertaken to make them suitable for use in the revision of the old survey sheets. The work will be on the largest scale yet done in this country, and for it a de Havilland Puss Moth machine, specially converted for the surveying operations, has been chosen. It will be equipped with a Pollock Brown gyroscopic automatic pilot, which is designed to keep the aeroplane on an accurate course, and on an even keel over the 24-mile runs up and down the area to be surveyed. A Williamson Eagle camera, fitted with a 20in. narrow-angle lens, will be used, and the photographs will be taken from a height of about 8000ft., the scale of the negatives being 12in. to the mile. Special Ilford films will be used, and when enlarged the prints will be made on a new type of paper with a metal foil core. It is expected that the survey operations will occupy about a month, and that the work of enlargement and rectification will be completed in about another three months.

Forestry in the British Empire.

IN the course of his presidential address at the annual meeting of the Empire Forestry Association, which took place at Australia House on Monday, June 24th, Lord Stonehaven said that "in surveying the position of forestry in the Empire during the past few years, one was forced to the conclusion that progress had not been very marked; in many countries there had been definite retrogression and in others the process of exploiting the forests without any thought for their permanence continued. Retrenchments in staffs had been severe, and there had been little evidence that there was a proper appreciation of the fact that forestry should play a definite and more permanent part in the rural economy of every country." Lord Stonehaven put forward the suggestion that the Association could do a very great deal to improve the present state of things by educating public opinion throughout the Empire. It might also make representations in a constitutional way to individual Governments in certain circumstances. For such action to be effective it was essential, said Lord Stonehaven, that the Association should have a membership much larger than its present 1200 members. Continuing, he said that in September the fourth Empire Forestry Conference was to be held in South Africa, and the Association was sending as a delegate its secretary-editor. The funds for that visit had been provided by the Rhodes Trustees, and that action rather suggested the possibility of getting some outside body like that Trust, with funds at its disposal, to come to the assistance of the Association for the further development of its work.

Profit-Sharing in 1934.

ACCORDING to the Ministry of Labour reports, there were at the end of 1934, 436 profit-sharing and co-partnership schemes in operation in Great Britain and Northern Ireland. Although this figure shows a decrease of thirteen schemes when compared with the preceding year, the number of participating employees increased, there being approximately 219,000 against 216,000 in 1933. The total pay-roll of the firms concerned last year was 377,000. A decline is also noted in schemes organised by purely commercial business firms, there being 277 schemes in operation at the end of the year, against 283 in 1933. Of these 277 schemes, 37 were concerned with the metal, engineering, and shipbuilding trades. The firms in this group employed about 55,700 workers, of whom 18,700 were participants. Financial details of the results were obtained of 218 schemes operating in ordinary commercial business. These schemes concerned firms with a total of 210,500 workers, the 158,600 participants receiving an average of £11 11s., giving 5·8 per cent. addition to wages. In the aggregate over 1¾ million pounds was distributed. In the metal and engineering section particulars are given of 23 schemes, in which 15,600 employees are entitled to participate, the average bonus being £2 19s. 9d., or 2·6 per cent. addition to earnings. One new scheme was reported to the Ministry during the year. It was organised by a firm of brick and tile manufacturers having 500 employees. The agreement provided for an annual bonus to each adult worker equivalent to the dividend on eight preferred ordinary shares for each complete year of service up to ten; employees under 21 years of age to receive a bonus at half rate. Of the seven schemes discontinued, one, started in 1907 and having 11,250 participants, was organised by a firm of mine and quarry owners and ironmasters. The reason given for the cessation is the reorganisation of the capital structure of the company. A motor engineering company has also withdrawn its four-year-old scheme. There were about 50 employees and with the termination of special concessions for the acquisition of shares the scheme automatically came to an end.

Oil from Coal.

THE Commissioner for Special Areas, Mr. P. M. Stewart, states that a grant of £2500 has been offered to the South Wales Industrial Development Council for an investigation into processes for the production of oil from coal, and that further grants up to a total of £7000 have been offered for other activities. It may be recalled that some time ago alternative schemes for hydrogenation plants and low-temperature carbonisation plants were put before the Council, but were then ruled out on the grounds of too high a cost. The claim of South Wales for Government assistance, along the lines of the Billingham hydrogenation plant, was argued before Lord Portal on the occasion of his investigation into industrial conditions last year, and was again pleaded before Mr. P. M. Stewart. The matter is in too early a stage as yet for the South Wales Industrial Development Council to make a definite statement, but it is hoped that fuller details of the proposed scheme will be available at no distant date.

A Forty-Hour Week.

ON June 25th the International Labour Conference concluded its nineteenth session at Geneva. Besides unanimously adopting a resolution concerning the unemployment among young persons which was mentioned in our last week's Journal, it decided to apply the double discussion procedure to the conventions for the iron and steel industry and for coal mines. Signor de Michelis, Chairman of the Governing Body of the Organisation, announced that the principle of the 40-hour week had been adopted by the Conference, and that information would be supplied to Governments which would facilitate the eventual adoption and general application of the principle. His optimism concerning the future of this method of factory organisation was not shared by Monsieur Jouhaux, Vice-President of the Conference. He expected that since the 40-hour week would be a matter for general adoption in all industries, and not a question merely for adoption in individual trades, he foresaw a long series of discussions before the universal application was finally settled. Mr. Harold Butler, Director of the I.L.O., pointed out that the decision of the Hours Committee and its endorsement by the Conference was a turning point in the history of the Organisation, altering as it did one of the fundamentals of its constitution, Article 41 of which made the 48-hour week and the 8-hour day an objective. The new resolution suggested an alteration of this to a 40-hour week.

The National Physical Laboratory.

THE National Physical Laboratory official inspection by the General Board took place at Teddington on Tuesday, June 25th. There was a large gathering of engineers and scientists, and the party was received by Sir F. Gowland Hopkins, President of the Royal Society, and Chairman of the General Board; Lord Rayleigh, the Chairman of the Executive Committee, and Sir Joseph Petavel, Director of the Laboratory. Considerable interest was shown in the work going on in the William Froude Laboratory, where the Lithgow propeller-testing tunnel was demonstrated, and experiments on the reduction of pitching and heaving in ships were illustrated. The new wind tunnel in the aerodynamics department, designed for a wind speed of 650 miles per hour, was shown working, and other experiments in this department dealt with apparatus for recording atmospheric gusts, and research work on high-pitch airscrews. In the engineering department, among other new items, were new fluid-pressure cupping tests for sheet metal, and the demonstration of stability of construction in thin sheet metal panels. Work of special interest to engineers included research on the maintenance of the tightness of steam pipe flanges. For this investigation two lengths of 8in. steam pipe, on which the test flanges are mounted, are employed. The whole assembly is heated to 1000 deg. Fah., and steam up to a pressure of 1400 lb., generated in an electrically heated boiler, can be admitted to the test pipes. The deformation of the flanges and the creep of the bolts are carefully measured. In the metallurgy department the whole subject of magnesium alloys is being investigated with the object of developing light alloys stronger than those at present available for use at ordinary and high temperatures, such alloys being demanded by aircraft constructors.

River Thames Improvement Scheme.

EARLY in 1929 it was decided by the Surrey County Council to carry out extensive improvements to the river Wey, in order as far as possible to mitigate the damage caused by flooding. The scheme was known as "The River Wey Improvement Scheme," and was estimated to cost £240,000. The river Wey discharges into the Thames just below Shepperton lock, and it was realised that the contemplated improvements of the former, which were to be of a radical nature, would add to the flood volume entering the Thames at this place. It was considered that the maximum extra volume of flood water to be dealt with might amount to as much as 1000 million gallons per twenty-four hours in times of high flood. This would necessitate similar improvements to the Thames from Shepperton down to the limits of the Conservators' jurisdiction, about 250 yards downstream of Teddington lock, if flood conditions of the latter river were not to be worsened. The result of such an addition to the flow of the Thames would be to raise the level of the water in the river to a considerable extent, but, of course, in varying degrees at different points, according to the freedom or restriction of the channel in its present condition, and its capacity to deal with such an increased flow. The frequency and duration of floods would also be increased. It was decided, therefore, to make provision, so far as possible, for reducing the levels of a flood of approximately 8000 million gallons per twenty-four hours, gauged at Teddington, to the levels now pertaining to those of a "bank-high" river. In this connection it may be noted that when the natural flow of the river, as gauged at Teddington Weir, is at the rate of some 4500 million gallons per twenty-four hours, the river is considered to be flowing "bank-high," and when the flow at Teddington exceeds this amount it is considered to be "in flood."

Before consideration of the improvement works to the river Thames between Shepperton and the lower limit below Teddington Weir could be proceeded with, it was necessary to estimate the flow at various points between these two places resulting from the considerations indicated above. The following figures were adopted:—

At Teddington Weir, 8000 million gallons per twenty-four hours = 14,800 cusecs.

At Molesey Weir and above, 7500 million gallons per twenty-four hours = 13,875 cusecs.

A survey of the length of the river under consideration, between Shepperton and the lower limit below Teddington Weir, a distance of about 11¾ miles, was then undertaken, and the information so obtained formed a basis on which a detailed calculation could be begun. To meet the conditions of flow and to bring about a lowering of the water level at Teddington by some 12in. below that which obtains at present for a flow of about 8000 million gallons, which is of the order required to fulfil the desired conditions, it was necessary to increase the discharging capacity of Teddington Weir.

It was now necessary to examine the river channel between Teddington and the weir immediately above, namely Molesey, with a view to determine its adequacy or otherwise to carry the volume of water proposed, the method being to provide the requisite sectional area by means of bank widening or deepening by dredging, or in some cases by a combination of both.

The following works, other than dredging, were found to be necessary, and were subsequently carried out in the Teddington–Molesey reach. A map, reproduced in Fig. 1, shows the sites at which they were carried out.

Enlargement of Teddington Weir.

Widening of river opposite Teddington Weir.

Widening of river between Hampton Court Bridge and the mouth of the river Ember on the Surrey side.

Widening of the river above Hampton Court Bridge, Middlesex side.

Removal of a portion of Ash Island in the Molesey Weir stream.

An examination of the discharging capacity of Molesey Weir was next undertaken, and it was found necessary to increase it.

The following works were found to be necessary, and were subsequently carried out in the Molesey–Sunbury reach:—

Enlargement of Molesey Weir.

Removal of part of island below Sunbury Lock, Middlesex side.

Removal of part of Sunbury Lock Island.

Widening and straightening of Wheatley's Eyot backwater and construction of new bridge.

The remaining works were all located between Walton Bridge and Shepperton Weir, and, taken together, constitute the largest proportion of the improvements carried out under the scheme. They consist of:—

Widening of the river immediately above Walton Bridge, on the Middlesex side.

Construction of flood relief channel at Walton, about ¾ mile in length.

Widening of the river immediately below Shepperton Weir, on the Surrey side.

In certain places it was found impracticable to obtain the necessary sectional area by bank widening alone, and in others it was not possible to widen at all. Under such circumstances it was necessary to deepen the river by dredging, and throughout the period of the scheme there have been two ladder dredgers and three grab dredgers constantly at work between Shepperton and Teddington.

A total quantity of approximately 320,000 cubic yards, measured *in situ*, has been raised and removed to spoil grounds. In addition, some 134,000 cubic yards of material have been excavated by drag-line excavators and disposed of by raising the level of the adjacent land above flood level.

Enlargement of Teddington Weir.

The plan, Fig. 3, shows the arrangement of the weir as now existing after the reorganisation, completed in 1932. It also shows the alignment prevailing before the commencement of the improvement scheme in 1930. The siting of the new roller sluices and the new gauge weir are clearly shown, together with the land which it was found necessary to remove, both to accommodate the new works and also to facilitate the passage of water to the weir. The whole of the site of the new works, including that of the old gauge weir, was inclosed in a cofferdam, constructed of 15in. by 5in. section Universal Joist steel sheet piling, supplied by the British Steel Piling Company, Ltd. This dam had to be driven across the site of the old weir pool, which necessitated the removal by diver of concrete blocks and bags, forming part of the old apron below the weir. The piles in the upstream and downstream portions of the dam were fish-

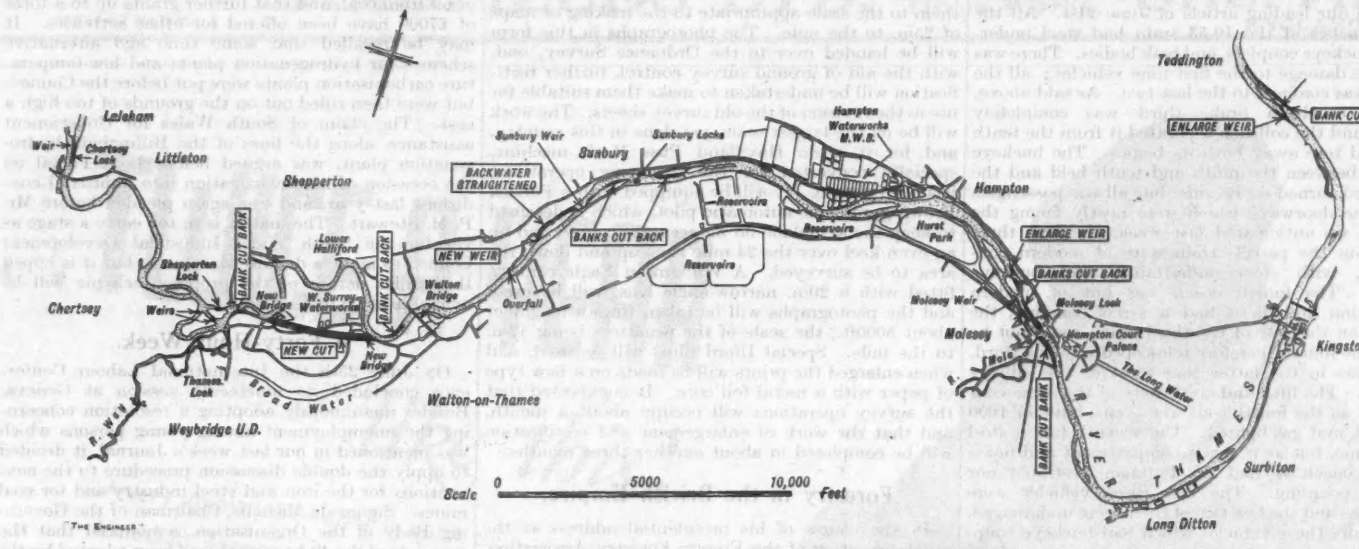


FIG. 1—MAP OF THAMES BETWEEN CHERTSEY AND TEDDINGTON

FIG 2—TEDDINGTON LOCKS AND WEIR

plated to enable the tops to be drawn on completion, leaving the bottoms as permanent protective toe piling to the foundations of the weir. A certain amount of difficulty with leakage was experienced, chiefly through water finding its way within the dam through the foundations of the pier of the existing weir at the north end. This percolation was, however, easily controlled by pumping, and the fissures sealed, before concreting-in the foundations of the new roller sluices.

The deep sill portion of the new weir consists of two bank of the river. Its foundation work is very similar to that of the roller sluice weir, consisting of mass concrete about 4ft. thick, with steel toe piling at the upstream and downstream ends, tied together with 1¼in. diameter steel bars. The weir itself consists of the frames, sills, gauge plates, &c., from the old gauge weir, re-erected on the new foundation.

River Walls Above and Below the New Weir.—New river walls had to be constructed, both above and below the site of the new weir. The upstream wall,

Dolphins and Booms.—The main weir is protected by floating booms and dolphins.

Enlargement of Molesey Weir.

The plan, Fig. 4, shows the arrangement of the "back-weir" portion of Molesey Weir before the additional deep sill weir was constructed, and it also shows how the enlargement was effected. The new weir consists of three sluices of the roller type, each 25ft. clear span by 8ft. 6in. deep, the depth of water over the sill that is retained being 8ft.

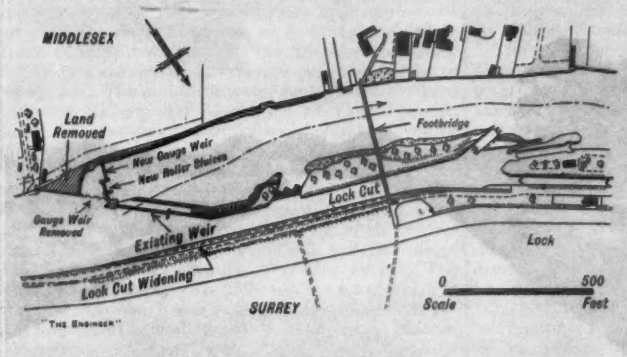


FIG. 3—PLAN SHOWING ENLARGEMENT OF TEDDINGTON WEIR

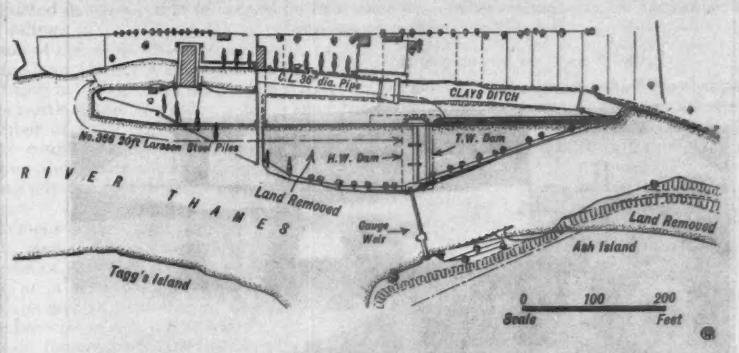


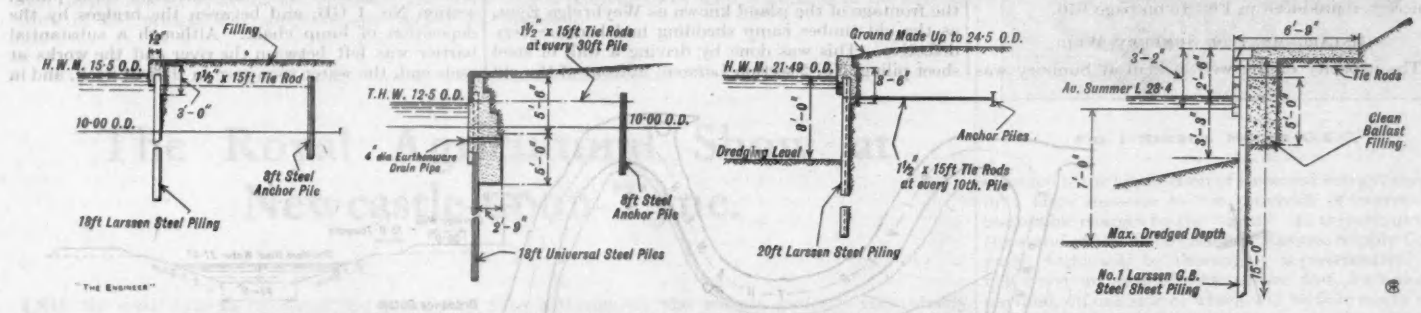
FIG. 4—ARRANGEMENT OF MOLESEY WEIR

clear span openings of 35ft. each, the depth of each gate being 11ft. 6in. and the normal height of water retained being 11ft. The maximum height of lift of gate above sill level is 15ft. The whole of the steelwork was supplied by Ransomes and Rapier, Ltd., of Ipswich.

The foundations, abutments, and central pier of the weir were constructed in mass concrete, the foundations being approximately 5ft. in thickness, and the abutments and central pier 7ft. and 6ft. of which a section is given in Fig. 5, consists of Larssen steel sheet piling, No. 2 section, 32·92 lb. per foot run, driven to Standard Head Water level, 15·50ft. above Ordnance Datum. A 12in. by 6in. hardwood waling was fixed to the face of this piling and a dwarf concrete wall constructed above, the finished level being 17·00ft. above O.D. The wall was anchored back by means of 1¼in. diameter mild steel rods to piles at approximately 12ft. intervals. The depth of water immediately in front of the wall

The whole of the site of the new work was enclosed in a cofferdam of steel sheet piling of 15in. by 5in. Universal Joist section supplied by the British Steel Piling Company, Ltd. There were no obstructions to hinder driving in this case, and the work proved considerably easier to carry out than that at Teddington. The dam was driven in the virgin ground, closed at each end, and the material inside excavated to the required levels.

There are three steel gates of the fixed roller



FIGS. 5, 6, 7, AND 8—RIVER WALLS ABOVE AND BELOW TEDDINGTON WEIR, AT MOLESEY AND AT WEYBRIDGE EYOT

respectively. Reinforcing steel bars were introduced under each of the latter as a precautionary measure. The upstream and downstream toe piling protecting these respective faces of the foundation were interconnected by 1¼in. diameter mild steel tie rods. The superstructure forming the operating platform is carried out in reinforced concrete.

Gauge Weir.—The gauge weir, which is 70ft. in length, is accommodated between the end of the new roller sluices, described above, and the Middlesex is 6ft., increasing to 11ft., 25ft. out from the wall.

Below the weir the section of the new river wall is as shown in Fig. 6. It is of similar type, but of heavier construction, and is faced with blue bricks, its top level being at 15·50ft. above O.D. The standard range of water level is from T.H.W. 12·50ft. above O.D. to 6·50ft. above O.D., low summer level, but this range varies considerably, owing both to the increased rise of the tide and the non-lowering of the sluices at Richmond, which occurs periodically.

FIG. 9—FLOOD RELIEF CHANNEL AT WALTON

type, each 25ft. span by 8½ft. in depth, designed to withstand the full head of water with no back pressure. Each gate is built up of two main girders supporting steel skin plating, $\frac{7}{16}$in. in thickness. They are each fitted with four anti-friction rollers of the roller and axle type. The rollers are of cast steel and are bushed with gun-metal and revolve on steel axles which are provided with fixed grease gun lubricators.

The gates are provided with round staunching bars, covered with rubber and self-adjusting. The bottom edge of each gate is fitted with an adjustable steel bar with machined edge closing down on to the machined face of the built-in steel sill girder.

The two intermediate weir frames are constructed of steel sections which were afterwards surrounded with concrete to facilitate the smooth and uninterrupted passage of water through the sluice, and cutwaters were also formed in concrete on the upstream end of the frames. The two abutments were formed in mass concrete, the steel gate frames being built in. The whole of the steelwork was supplied by Glenfield and Kennedy, Ltd.

The foundations of the weir were similar to those at Teddington. They consist of mass concrete, 4ft. thick under the frames and 2ft. thick between the frames, protected on both the upstream and downstream faces by steel toe piling.

An operating gangway in reinforced concrete is carried across the weir and the whole structure is covered over by a gallery carried out in oak timber, with an oak shingled roof. Protective walls were constructed both upstream and downstream of the new structure, and a typical section through the wall on the head water side is shown in Fig. 7. The downstream work was very similar, but to suit the local requirements a concrete pathway, 2ft. 6in. wide, was formed along the top of the steel piling and a 1 to 1 slope, pitched with ragstone, laid in concrete, carried up to a finished level of 23·50ft. above O.D.

A protective apron has been laid below the weir, 80ft. wide, *i.e.*, across the whole width of the new sluices and extending 39ft. beyond the downstream toe piling, making a total length of protective apron of 69ft. The portion beyond the steel piling consists of pre-cast concrete blocks, 3ft. by 3ft. by 2ft., laid in place by a diver on a levelled formation of concrete in bags also placed by means of a diver.

The last course of block work consists of a row of

similar-sized blocks placed on edge. A lip wall, 1ft. in height, is thus formed at the end above the general level of the apron, which is 7ft. below normal tail water level. Concrete bags were then placed in front of this course as filling up to the general level of the bed of the river, *i.e.*, 7ft. below normal water level. It is anticipated that the effect of this apron will be materially to reduce the effect of erosion of the bed of the river below the sluices. The sluices are protected by dolphins and floating booms, as in the case of Teddington Weir. They are of somewhat different design, however, the booms being provided with rollers on the meeting face to facilitate working up and down the dolphin. A photograph of the sluices is reproduced in Fig. 15 on page 670.

FIG. 10—BRIDGE OVER WALTON CUT

FIG. 11—VIEW OF WALTON CUT

ENLARGEMENT OF SUNBURY WEIR.

The capacity of the weir system at Sunbury was increased by constructing a new deep-sill sluiceway about 440ft. upstream of the main weir. The new weir is similar in every respect to the Molesey extension, except that in this case there are two gates instead of three. The steelwork was again supplied by Glenfield and Kennedy, Ltd., to the same specification as the work at Molesey.

A photograph reproduced on page 670 shows the upstream elevation of the finished weir. The balance weight boxes are clearly shown together with the method of covering in the weir frame with concrete to render the passage of water through the weir smoother than would otherwise be the case. The abutment is carried out in mass concrete. The balustrading and roof shingles and timbers are all in oak.

FLOOD RELIEF CHANNEL AT WALTON AND ANCILLARY WORKS.

The final portion of the flood prevention works between Shepperton and Teddington comprises the new channel and other works in connection therewith, of which a list has already been given. The plan—Fig. 12—shows the general scope of the various works entailed.

Beginning immediately below Shepperton Weir, the first work to be undertaken was the widening of the right bank of the river upstream of Weybridge Eyot, together with the diversion of the towpath and public footpath in the vicinity. This work comprised the formation of a new river wall and the excavation and dredging of a considerable quantity of material from the bank and the river. A typical section of the wall is shown in Fig. 13. Short lengths of Larssen steel sheet piling of section 1 GB were driven, a 9in. by 6in. waling in Jarrah timber fixed above Standard Head Water mark and the piling tied back to concrete blocks buried in the ground. A small concrete wall, 2ft. in height, faced with random rubble stone, was built on the top of this and the ground sloped back at 2 to 1. Landing steps in Jarrah timber were placed in the slope where required. The whole of the slopes and other newly filled areas were sown with grass seed and a new footpath and towpath, 15ft. wide, was formed.

It was considered advisable to protect a portion of the frontage of the island known as Weybridge Eyot, as the old timber camp shedding had become very defective. This was done by driving a wall of steel sheet piling, No. 2 section Larssen, in front of the old work and cutting the latter off at river bed level. A typical section is shown in Fig. 8.

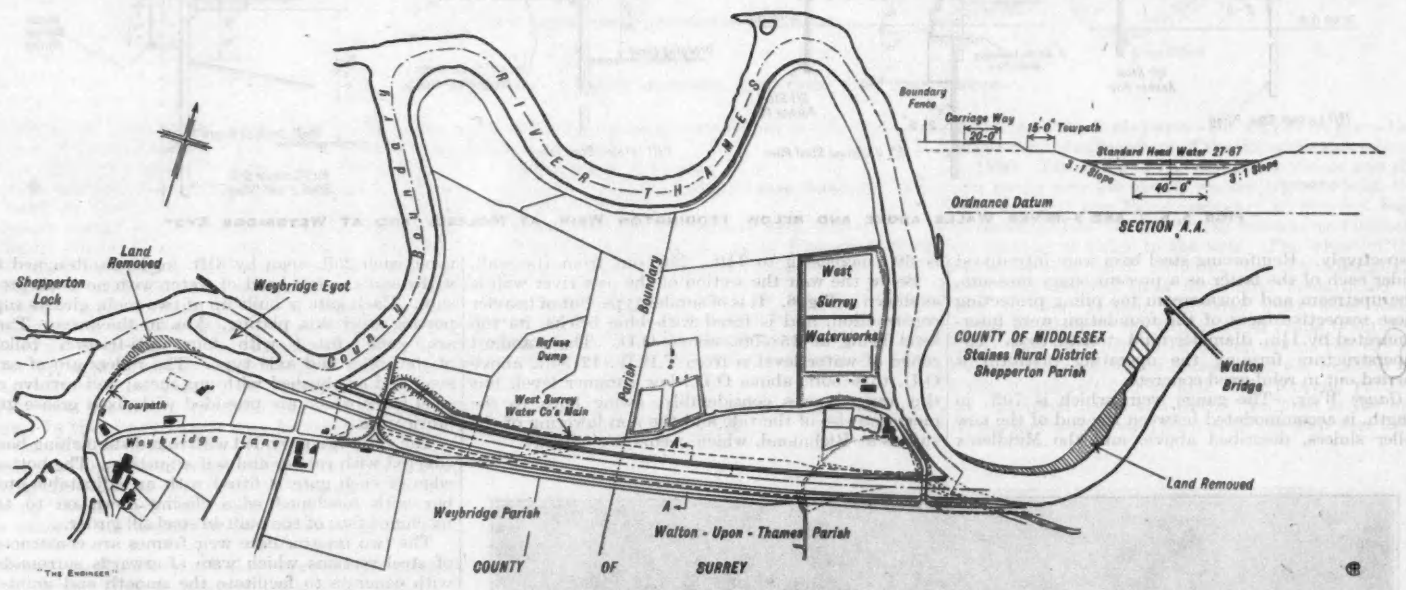


FIG. 12—PLAN AND CROSS SECTION OF WALTON FLOOD CHANNEL

FLOOD CHANNEL.

The flood channel consists of a new cut and banks approximately 1463 yards in length and 100ft. wide on the water line at Standard Head Water mark and 10ft. deep. The bottom width is 40ft. and the side slopes are 3 to 1, the gradient being 1 in 2400. A typical section is shown in Fig. 12. The whole of the excavation for this work, amounting to 190,000 cubic yards, measured *in situ*, was carried out by dragline excavators. The excavated material was used to form flood banks and road formations, and the surplus to these requirements was deposited on the adjacent land. The material was chiefly ballast and clay, which involved top-soiling of all banks and spoil dumps as well as finally sowing with grass seed on account both of their unsightly nature and of the fact that they become profusely covered with weeds in a short period of time if left. The sides of the cut below normal water level upstream and downstream of the two bridges have been protected by Larssen steel sheet piling, section No. 1 GB, and between the bridges by the deposition of lump chalk. Although a substantial barrier was left between the river and the works at each end, the water soon rose in the cut itself, and in order that the protective layer of chalk might be placed and rammed in the dry it was necessary to empty the cut by means of pumping. Above the water line the banks have been turfed for a distance of some 3ft. to 4ft., and above this again they have been sown with grass. It is anticipated that no undue distortion of shape will occur from water erosion or other causes in the channel treated in this way.

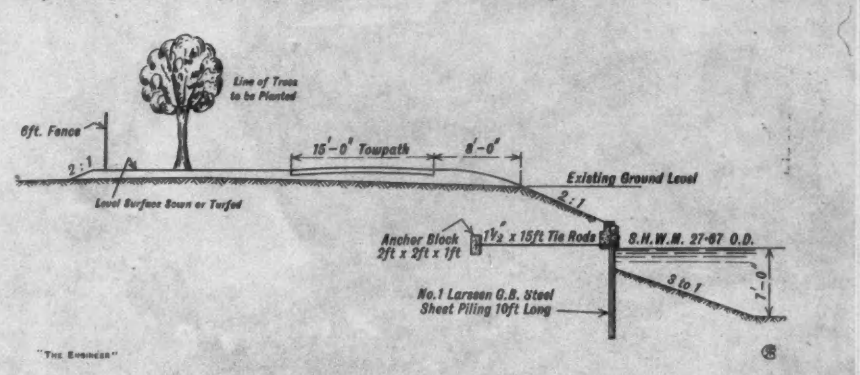


FIG. 13—NEW RIVER WALL BELOW SHEPPERTON WEIR

It will be seen by reference to Fig. 12 that the new cut severs the road known as Weybridge-lane, at the

same time isolating the pumping station and reservoirs of the West Surrey Waterworks Company. This roadway also carries three of the company's water mains, and it was necessary to divert them without interrupting the supply of water. The company also required road access to its works on both the north and south side of the cut. It was therefore decided to construct a road bridge at either end of the cut capable of taking main road traffic and to utilise these bridges for carrying the mains over the waterway. The type of bridge to be erected was controlled by the requirements of the company, which stipulated that a clear space, 18ft. wide by 5ft. high, was to be provided for its sole use on each bridge. A plate girder type of construction was therefore adopted. The bridges are similar in every respect and consist of three spans. The middle or water span is 84ft. between centres of main girder bearings, 80ft. clear between piers, and headway 17ft. above standard water level.

The main span consists of two plate girders, spaced 19ft. 6in. apart centre to centre, 5ft. 9in. deep over main angles, and 84ft. long between centres of bearings. The roadway is carried on the top of the girders by pressed steel troughing, $\frac{7}{16}$in. thick and 12in. deep. The length of the troughing is 26ft. 0$\frac{1}{2}$in. overall. The width between parapets is 25ft. and the clear width of roadway between kerbs is 20ft. The footways are therefore cantilevered out from the main girders. The water mains are carried on timber supports, which are bolted directly to the pipe bearers, which consist of 10in. by 4$\frac{1}{2}$in. by 25 lb. R.S. joists spaced at about 6ft. centres and carried on the bottom flange of the main girders. A floor of 2in. planking has been laid on the top of these bearers. Access manholes to this pipe chamber are provided in the roadway at each end. Provision has been made for four mains in each bridge and those laid at present consist of three 15in. pipes in the upstream bridge and one 12in. in the downstream bridge. The two short spans of the bridge on either side of the main span consist of a reinforced concrete decking carried on 24in. by 7$\frac{1}{2}$in. R.S. joists, spaced at about 6ft. centres. The steel work of the bridges was supplied and erected by Dorman, Long and Co., Middlesbrough. As it was considered that two plate girder bridges of these dimensions would prove unsightly and out of keeping with the rural nature of the surroundings, it was decided to treat the exterior surfaces with a covering of Jarrah timber, the balustrades also being constructed of the same material. The photograph reproduced gives a good idea of the general appearance of the superstructure when finished. After erection all exposed surfaces of the woodwork were treated with boiled linseed oil. The main piers of the bridges, together with the abutments and wing walls of the short spans, are constructed in mass concrete carried on "Vibro" concrete piling.

The remaining portion of the work consisted of the diversion of Weybridge-lane, about 1055 yards in length, and the construction of the new road, 508 yards in length, on the north side of the cut.

Finally a large number of trees and shrubs have been planted along the course of the new waterway and at either end above and below the two bridges with a view to rendering the site of the new works as picturesque as possible.

The Thames improvement scheme was commenced on March 29th, 1930, and will be completed by June 30th, 1935, a period of just over five years, and has been carried out at a cost of approximately £300,000, exclusive of the cost of supervision, which has amounted to a further sum of about £12,500.

The scheme has been financed by H.M. Government, the County Councils of Middlesex and Surrey, and the Conservators of the River Thames, and the entire work has been carried out departmentally by the Conservators' engineering staff, under the direction of the engineer to the Board, Mr. G. J. Griffiths, M. Inst. C.E., and the workmen employed have been recruited through the Ministry of Labour, the majority of whom have been drawn from depressed areas.

We are indebted to the Thames Conservancy Board for the information on which this article has been based and for many of the photographs reproduced. The photograph, Fig. 2, of Teddington locks and weir is reproduced by kind permission of the *Evening Standard*.

The Royal Agricultural Show at Newcastle-upon-Tyne.

No. I.

FOR the sixth time in its career the Royal Agricultural Society of England will hold its annual Show next week, from July 2nd to 6th, inclusive, at Newcastle-upon-Tyne, and, if the five previous exhibitions held in that city can be taken as criteria, the Society can look forward with confidence to a highly successful venture, notwithstanding the industrial depression which has persisted so long on the North-East Coast. The last occasion when the Show was held in the city was in 1923, when the turnstiles registered an attendance of over 186,000, the profit exceeding £19,000. Although the profit made on the 1908 Newcastle Show was only about one-half of that amount, the public attendance reached the second highest of all Shows, namely, 213,867, a figure which has been beaten only once, namely, at Manchester in 1897, when the number of visitors was nearly 218,000. Although the weather conditions at the time of the Shows, naturally, have a preponderant influence on the attendances, the records indicate very clearly that it is to the great manufacturing districts that the Society has to look for the funds to carry it over the lean years.

Although the Ministry of Agriculture, presided over by Mr. Walter Elliot, has not yet succeeded in restoring British agriculture to reasonable prosperity, there is certainly a better "heart" in the industry than there has been during recent years. There is, however, still room for a considerable reduction in the expenses of production, which have risen in some cases 80 per cent. above pre-war costs. Much of the increase is due to the cost of manual labour, and farmers will have to look more and more to engineers for the solution of this problem. Dairy farming has certainly been stimulated by the Government's milk marketing scheme, judging by the annual report of the Board, which is responsible for this branch of the industry. There is, however, still room for improvement in the methods of handling and treating milk by many producers, and dairy engineers ought to obtain increasing business in the near future. The Ministry of Agriculture will have a stand in the Show ground, where demonstrations of the Government national mark schemes for vegetable, meat, and dairy products will be given. There will also be exhibits designed to acquaint producers and the public with the work and objects of the milk, pig, and bacon Marketing Boards.

Beyond the silver medals which are offered annually by the Royal Agricultural Society for new implements there is no other competition of this nature for implement makers.

Electricity on the Farm.

In the period of twelve years which has elapsed since the Royal Show was last held in Newcastle there have been many important developments on the engineering side of agriculture and farming, not the least

FIG. 1—BARROW MOTOR—G.E.C.

of which is the application of electrical energy, thanks in a large measure to the provision of current at reasonable charges by the "grid." In this connection the stand of the North-Eastern Electric Supply Company, Ltd., will be thoroughly representative. It will cover an area of 9000 square feet, including a pavilion, on one side of which will be four rooms of a house furnished and equipped electrically. At the back of the pavilion there will be shown the electrical installation of a "certified" dairy farm, three sections being given over to the creamery, bottle and utensil washing, milk cooling and filling room, with a cow byre and milking machines. Another portion of the stand will be devoted to poultry farming with electrically heated incubators, brooders, and machines for plucking. For intensive forcing there will be an electric soil heating frame. The larger portion of the stand will, however, be taken up by farm machinery, all of which will be driven by electricity. The machines will include threshers, seed dressers, potato grading and turnip cutting machines, and woodworking machinery. In addition there will be a portion of a barn, containing barn machinery, such as a grinding and crushing mill, self-cleaning turnip cutter, chaff cutter, each driven by its own electric

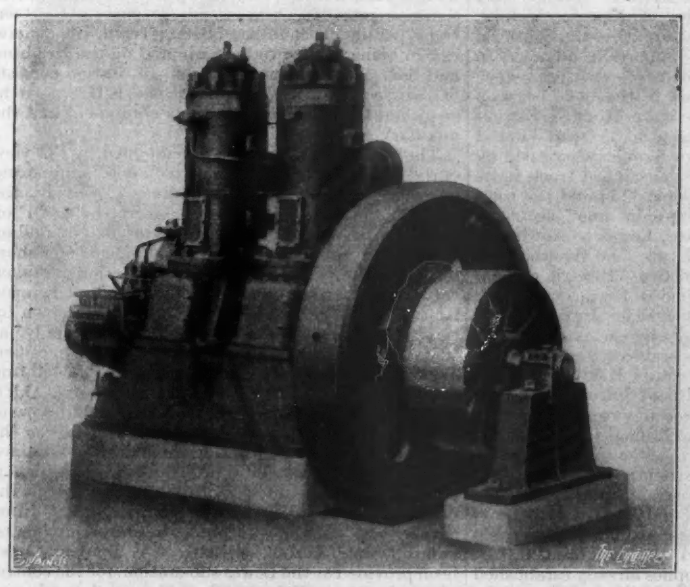


FIG. 2—112 B.H.P. "ATOMIC" OIL ENGINE—PETTERS

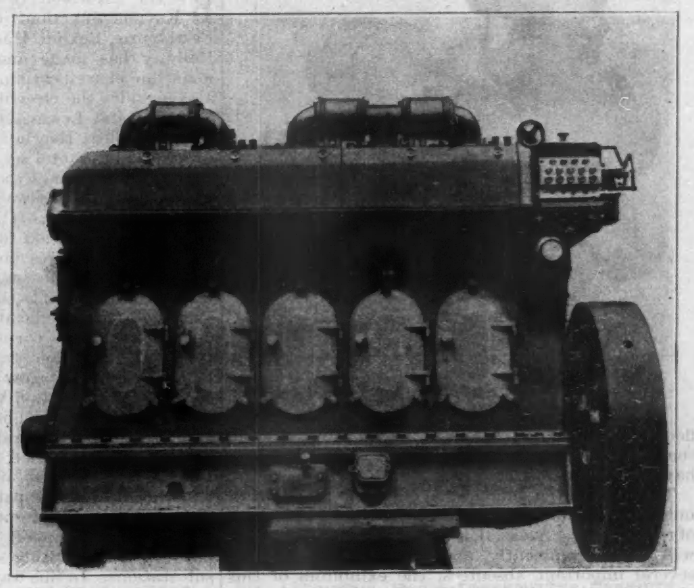


FIG. 3—150 B.H.P. OIL ENGINE—RUSTON

motor, and also a line of shafting from which will be driven other machines. Another feature of this company's stand will be the substitution of an electric boiler for the usual coal-fired boiler to provide all the steam for the Royal Agricultural Society's working dairy.

Farmers seeking for information on the subject of electrical supplies and the application of electrical energy to their appliances will derive help from the British Electrical Development Association's stand.

In view of the rapidly increasing demand for dairy sterlising equipment, the General Electric Company will make a special feature of self-contained steam sterilising chests. There will also be shown by this company a comprehensive selection of motors of

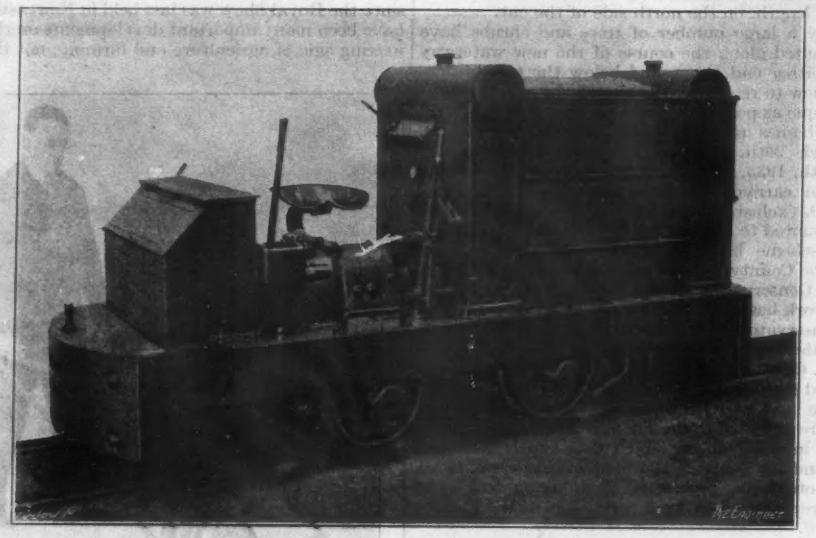


FIG. 4—18 - 21 H.P. OIL LOCOMOTIVE—RUSTON

various types suitable for farmers, amongst which the dual-speed barrow motor—Fig. 1—is intended to provide the power for a number of hitherto hand-driven machines running at various speeds. This equipment comprises a ½ h.p. geared motor with a fast and slow pulley running at 1440 and 240 r.p.m. respectively. The motor is mounted on a metal truck of triangulated construction, fitted with a Dunlop cushion wheel to facilitate transit over rough ground. The use of electricity for horticultural purposes will be demonstrated in two ways: one for heating the soil by means of a special cable with thermostatic control; and the other for controlling and stimulating plant growth by means of electric light. For the latter purpose the G.E.C. will show the "plant irradiator," which incorporates a red "Osira"

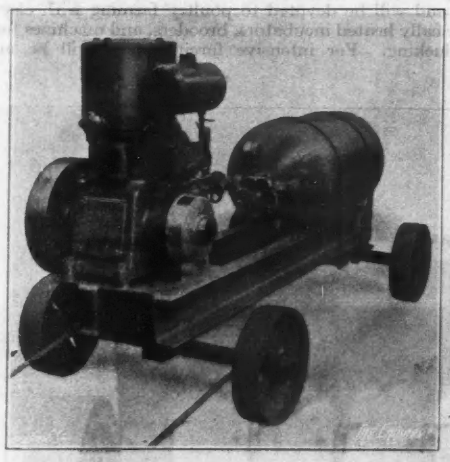


FIG. 3—AIR COMPRESSOR—RUSTON

flood-lighting lamp. It is claimed by the exhibitors that this lamp solves many of the problems which have been the subject of investigation in the past.

Turning to the implement exhibits, in point of numbers the Show will compare favourably with those of recent years. As usual, internal combustion engines will figure prominently, and although there will be several important absentees, the exhibitors of this class of engine will be well represented, and high-speed compression ignition engines will form a considerable proportion of the whole.

PETTERS LTD.

This firm will have a representative selection of engines for agricultural, industrial, and marine purposes. "Atomic" Diesel engines from 5 to 112 b.h.p., the latter with only two cylinders, will be seen. Our illustration—Fig. 2—represents a 112 b.h.p. two-cylinder engine of this kind with a fly-wheel and belt pulley.

Another interesting exhibit will be a small fully automatic electric lighting set operated by a Petter heavy-oil engine. It has a capacity of 2000 watts, and is fitted with electrically controlled gear, which enables the engine to start as soon as two or three lights are switched on. When the demand for current falls to a predetermined point, the engine is automatically stopped, the light load being taken by the battery. The great advantage of the arrangement is that the battery capacity is considerably reduced as only small discharges have to be provided for. Another automatic set operating on a similar principle, is one of 1000-watt capacity with a 2 b.h.p. air-cooled engine. These sets may be provided with an emergency lighting panel for use in hospitals, colleges, factories, cinemas, hotels, churches, docks, on board ship, and in similar situations. The automatic operation is controlled by an arrangement of switches which is such that should the main electricity supply fail, a master relay on the panel automatically and instantaneously switches on the emergency light; at the same time, the set starts up and takes over the load. Pumping sets will be represented by two examples—each in combination with a 2 b.h.p. air-cooled petrol engine. One of these pumps consists of a horizontal, double-acting unit with an output of 388 gallons per hour against a head of 200ft., and the other will be of the centrifugal high-capacity, low-lift type.

RUSTON AND HORNSBY, LTD.

Oil engines will form the most important feature of Ruston and Hornsby's stand. There will be two cold-starting, horizontal engines, one of 47 b.h.p., running light, and one of 13 b.h.p. driving a generator by V belt to provide current for use on the stand. The V-belt transmission is claimed to be ideal where both head room and floor space have to be considered. Amongst the vertical engines there will be three distinct types, the largest being a five-cylinder, 150 b.h.p. engine, with a normal running speed of 600 r.p.m. As seen in the illustration—Fig. 3—this engine is totally enclosed. It is automatically lubricated and starts from cold by compressed air. Large doors give access to the crank shaft and connecting-rods, and the valve gear is accessible by easily detachable covers. Another vertical engine is a four-cylinder unit giving 70 b.h.p. at 1000 r.p.m., and a third is a three-cylinder engine giving 26½ b.h.p. at 1000 r.p.m. The last-mentioned engine has the Lister patented combustion chamber in which compression can be varied as desired for starting and normal running. This engine can be started from cold by hand. The marine oil engines will be of special interest to North-East Coast engineers. One, with three cylinders, develops 52 b.h.p. at 1000 r.p.m. It is shown complete with reverse and reduction gearing and stern gear, and has an automatic advance and retard mechanism on the fuel pump which permits long, continuous running at slow speed—a feature which will be appreciated by fishermen. The second engine of this class has four cylinders, giving 36 b.h.p. when running at 1000 r.p.m. It also has the Lister combustion chamber and is started electrically. Both of these engines are of the compression-ignition type.

The Ruston oil locomotive which is illustrated in Fig. 4 is built in four sizes, namely, 10, 18–21, 27–32, and 36–42 h.p. The illustration represents the 18–21 h.p. model. Three travelling speeds are available in either direction, and the changes of gear are effected by a single lever, without any foot action. All the gears are permanently in mesh. The engine is started by hand and runs on light fuel oils. The portable air compressor shown in Fig. 5 is to be exhibited for the first time at Newcastle. It is mounted on a strong steel frame which is carried on four wheels. The compressor is of the vertical type, single-stage, hopper-cooled, and is driven by a 1½–2 h.p. totally enclosed and automatically lubricated vertical engine, which runs on petrol. Two other compressor sets will be shown, one of which is belt driven from a 1½ h.p. petrol-paraffin engine.

(To be continued.)

Southern Railway Electrified Extension.

BY the extension of its electrified system from Keymer Junction to Lewes, Newhaven, Seaford, Eastbourne, Bexhill, Hastings, and Ore, the Southern Railway has made another important advance in main line electrification. This new extension, which also includes the electrification of the lines between Brighton and Lewes, and between Horsted Keynes and Haywards Heath, as shown in the map—Fig. 1—increases the total single track miles electrified by over 129, and brings the total electrified track miles of the Southern Railway to some 1156 and the total route miles to 444. The new main lines electrified are Keymer Junction to Lewes, Lewes to Newhaven and Seaford, Lewes to Polegate and Eastbourne, and Polegate to Hastings and Ore. Electric express trains from London to the principal towns on the new extension (to be officially opened on July 4th) will operate over lines covered by the earlier extensions between the London stations and Keymer Junction, a point situated below Haywards Heath Station, a short distance north of Wivelsfield Station.

As in the case of all other recent extensions, power is derived from the grid. Additional feeding points have been established *viâ* the Central Electricity Board's sub-stations at Eastbourne and Hastings, and the railway company has laid an E.H.T. cable between each of these points, and also between Eastbourne, and a tee off the company's feeder cable between Three Bridges and the Brighton C.E.B. sub-stations. In this way supplies already established for the Brighton extension are made use of for the new extension, and virtually a ring main has been obtained. The H.T. and pilot cable runs are similar to those on the Brighton extension.

Following the railway's recent practice, the E.H.T. cable is looped into and out of the railway sub-stations *en route*, tee off connections being made to those sub-stations not on the main route of the cable. Energy is supplied at 33,000 volts, 50 cycles and is distributed at this pressure to each of the sub-stations, in which it is converted to 660 volts D.C. for the conductor rails. Each sub-station is provided with a 2500 kW mercury arc rectifier equipment, as shown on page 666. Sixteen sub-stations and fourteen track paralleling huts have been erected, the general design being similar to that adopted on the Brighton and Sevenoaks extension. Each sub-station consists of two sections, one comprising the E.H.T. switchgear, and the other the rectifying equipment and the auxiliary switchgear.

The E.H.T. switchgear, as exemplified by the view of the Newhaven sub-station on page 666, is supported on reinforced concrete structures. Each of the incoming E.H.T. feeders is connected to an oil switch with a rupturing capacity of half a million kVA, and is connected to the opposite ends of a short bus-bar from which a tee off connection is taken through a similar oil switch to a main oil-cooled transformer. The 33 kV supply is stepped down by this transformer into a double six-phase supply, at the voltage required at the anodes of the rectifier. Energy for signalling, lighting, and other sub-station auxiliaries is obtained from single-phase, 20 kVA transformers, one of which is connected direct to each of the two incoming feeders. Current for the rectifier and other sub-station auxiliaries is obtained from a three-phase, 30 kVA transformer, which is connected to the same tee-off points from which the main supply is taken to the rectifier. In addition to the two standard incoming feeder equipments, two outgoing E.H.T. switchgear equipments have been provided at the Lewes sub-station, for the control of one feeder to Falmer sub-station, and another to the Southease and Newhaven sub-stations.

Falmer sub-station is provided only with the oil switch equipment necessary for the control of the main supply to the rectifier, so that a very compact design has been obtained. Arrangements have been made, however, at this sub-station for expansion of the E.H.T. switchgear on standardised lines if and when it becomes necessary. The arrangements for the remainder of the equipment at this sub-station are similar to those at a standard sub-station. The mercury arc rectifiers are duplicates of those installed

on the Brighton, West Worthing, and Sevenoaks extensions. Each has a continuous capacity of 2500 kW, corresponding to 3790 ampères on the D.C. side; but greater currents can be given for specified periods. The rectifiers are water cooled by means of a closed circuit, thermostatically controlled. The local control gear for the E.H.T. switchgear rectifier and auxiliaries is contained within a cabinet faced by a flush-type switchboard., divided into three panels, as shown in Fig. 2.

The positive lead from the rectifier is taken through a main high-speed breaker of a continuous carrying capacity of 4000 ampères, to a bus-bar from which connection is made to the track feeders through smaller high-speed circuit breakers, as shown in Fig. 3. Each circuit breaker is provided with isolators, so that it can be taken out of circuit when necessary without disturbing the supply of the remaining units. The local control equipment for each track feeder circuit breaker is mounted on a panel placed below the shelf carrying the track feeder breakers. Feeder cables connected to the track rails return the current to the negative bus-bar, which is, in turn, connected to the neutral point of the main transformer through the absorption choke coils.

All the electrical equipment in the sub-stations is arranged for remote operation by supervisory control, and the positions of the circuit breakers in the track paralleling huts are also indicated by the same system. Three Bridges control room—shown on page 666—constructed for the electrification extension to Brighton and West Worthing, has been provided with additional equipment to extend its control over the sub-stations and track paralleling huts in the new area as far as Eastbourne and Seaford. The new panels, which are exactly similar in appearance and design to those previously erected, are arranged along the straight wall of the control room, which now controls twenty-nine sub-stations. A new control house, similar in design to that erected at Swanley for the Sevenoaks extension, has been erected at Ore for the control of the sub-stations and track paralleling huts on the section between Polegate and Willingdon junctions and Ore. The panels at Ore are arranged along the curved wall, leaving ample space for future extensions. By means of mimic bus-bars and switch units the whole of the main power circuits for the supply of energy to the conductor rails is represented on the main control board in the control rooms. Each unit represents an oil switch or a D.C. circuit breaker, and consists of a red, green, and white lamp and two operating keys.

The procedure to be adopted to operate a switch in a distant sub-station is as follows:—The key marked "call" of the selected switch unit is first depressed, and releases a contact arm which rotates over a segmented face-plate situated in a transmitter cabinet, as shown in Fig. 4. Simultaneously a similar arm rotates step by step synchronously over a similar face-plate in the distant sub-station. If everything is in order when the arm reaches the position corresponding to the particular "call" key depressed, it stops and a white lamp on the switch unit glows to indicate that this part of the operation is satisfactorily carried out. At the same time the selector arm in the distant sub-station stops. Should, however, for any reason the arm occupy a position which does not exactly correspond with the arm in the transmitter cabinet, electrical interactions occur to resynchronise the two arms automatically. A single white lamp mounted on the centre of the sub-station panel remains dark whilst resynchronising is occurring and no operations whatever can be carried out from the panel until normal conditions are restored. With normal operation of the selector this particular white lamp glows steadily, but flashes intermittently whilst the selector is moving from one position to another. The distant oil switch or circuit breaker having been satisfactorily "called," it may then be operated by the agency of a second key. Satisfactory operation is indicated by a red and green lamp, one of which glows to indicate the closed or open position of the switch.

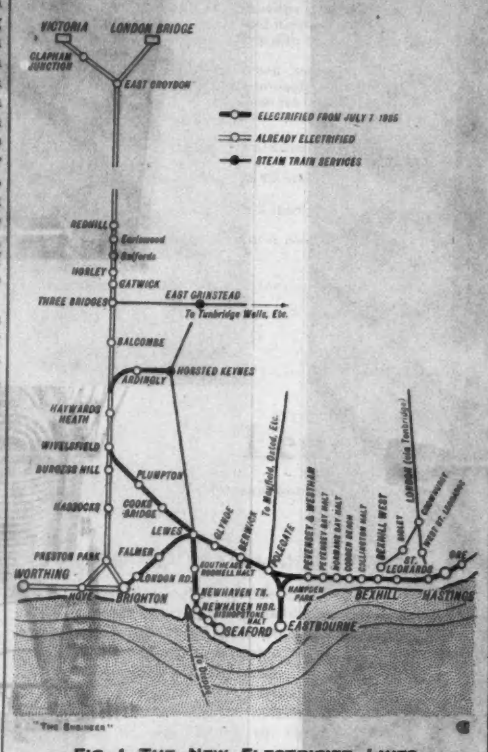


FIG. 1—THE NEW ELECTRIFIED LINES

In the case of E.H.T. feeder oil switches an additional orange lamp is provided, by means of which the difference of the frequency of the supplies on the two sides of the switch is made visible before the operation of closing. The lamp glows steadily when the two supplies have the same frequency and at other times blinks at a rate depending on the difference of the frequencies. All that is necessary to put a sub-station into commission is to close the oil switch controlling the rectifier transformer. Other auxiliary equipment at the distant sub-station comes automatically into action and is so interlocked that faulty operation of the sub-stations is obviated.

Load conditions at the distant sub-station may be observed by indicating instruments which are connected in circuit when a special key marked "meters" is operated. Readings to these instruments are transmitted through the selector system by means of a balanced beam potentiometer system. All the oil switches and D.C. circuit breakers in the sub-stations are provided with protective arrangements. When one of these switches automatically trips, the fact is signalled to the control room by the ringing of a bell and the flashing of a clear lamp at the top of the panel representing the sub-station in which the particular switch is situated, and these conditions persist until the attendant has operated a resetting key. The attendant first proceeds to discover which of the switches has automatically tripped by means of a "check" key. The operation of this key causes the selector arms to rotate and to connect in succession each one of the switches to their appropriate indicating units. When the selector passes over the contacts corresponding to the switch in question the indicating signal lamps change over from red to green and the attendant then either recloses the switch or confirms its new position, either of which operations will clear the fault signalling. The rectifier D.C. circuit breakers and the circuit breakers provided in the track paralleling huts are entirely automatic in action, and when one of these switches automatically trips the fault indication is removed as soon as the indication on the control board corresponds with the position of the switch. This occurs as soon as the selector arm passes through the position occupied by the contacts of the switch during the "check" operation.

To inform the staff at Three Bridges and Ore control rooms of the exact conditions of the supply to their respective areas the E.H.T. feeder oil switches at Eastbourne controlling the supply to the railway company, together with certain switches in Willingdon Junction sub-station, are indicated at both control rooms. Operation of these switches, however, is only effected from one control point. A telephone exchange to all sub-stations and track paralleling huts is accommodated in a desk which is situated at the centre of the floor in each control room. A system of "calling" keys and meters for testing the supervisory pilot wires is also mounted on the desk. The control system is fed by two 250 ampère-hour 120-volt centre-tapped secondary batteries at the control room and from similar batteries of 50 ampère-hour capacity in the distant sub-stations. The sub-station batteries are normally trickle charged through metal rectifiers, arrangements being made to give full charge if necessary. The control room batteries are charged by duplicate motor generators. One of these machines is driven by a D.C. motor for which a source of supply at 660 volts is obtained from the conductor rails. The other motor generator is driven by a three-phase motor supplied from the auxiliary A.C. supply in the adjacent sub-station. These batteries are charged through an equipment contained within cubicles bolted together to form a complete unit. The equipment is automatic in action and is arranged to maintain the supply of energy to the control boards and supervisory system should either or both of the sources of supply fail.

Under normal conditions one generator supplies the energy for the control board and trickle charges one battery, the remaining battery acting as a standby. Should, however, the supply for the motor generator fail, the motor generator connected to the other source of supply automatically starts up to carry on the service of the previous generator. If, for any reason,

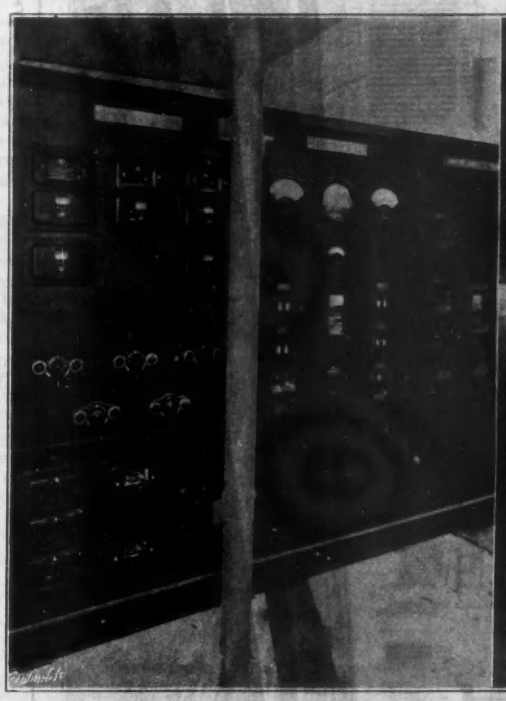
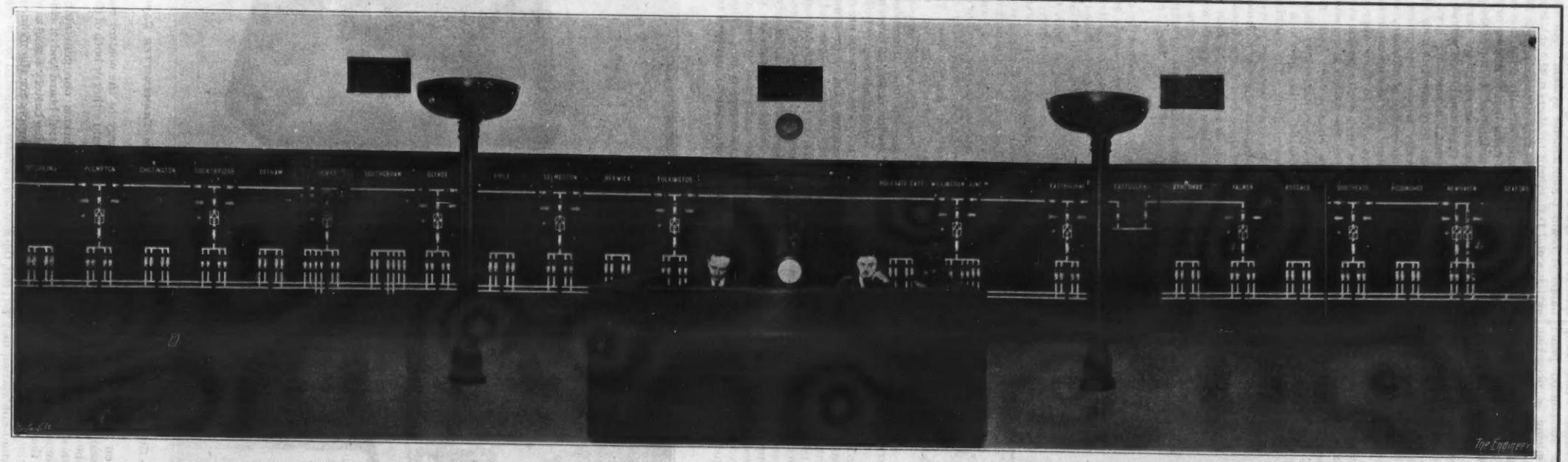


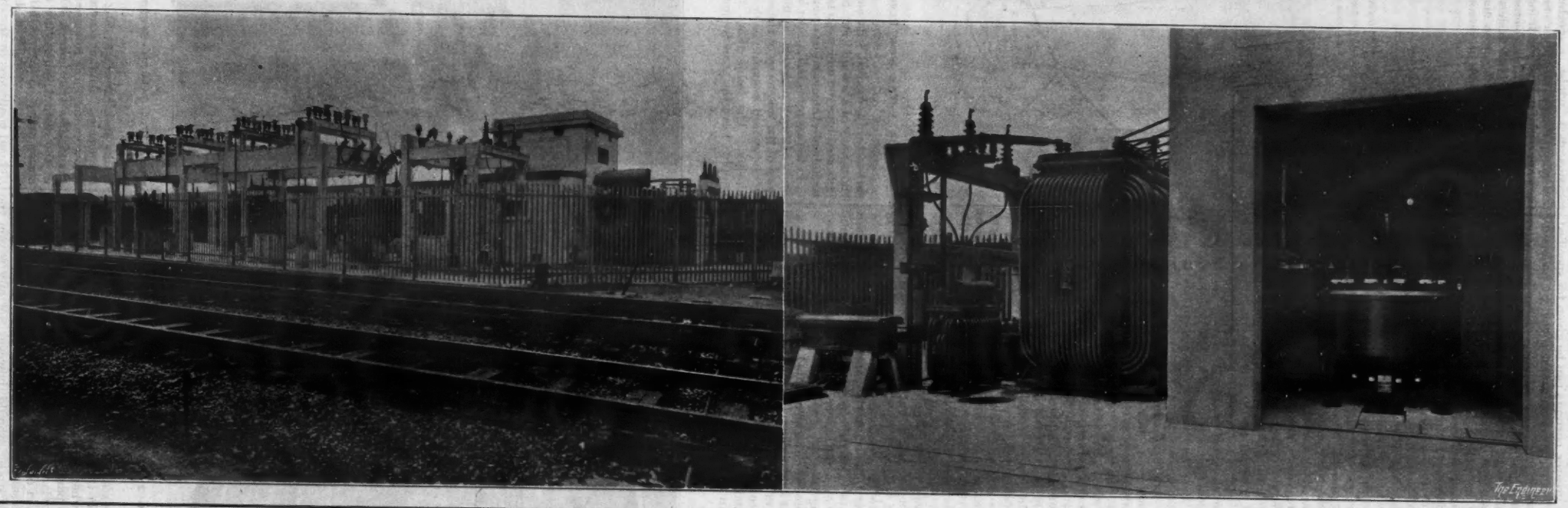
FIG. 2—LEWES SUB-STATION CONTROL SWITCHBOARD

FIG. 3—HIGH-SPEED CIRCUIT BREAKERS

FIG. 4—CONTROL ROOM TRANSMITTER CABINETS

SOUTHERN RAILWAY EASTBOURNE AND HASTINGS ELECTRIFICATION SCHEME





(Above):—The Three Bridges Control Station

Newhaven Sub-Station, E.H.T. Switchgear and Auxiliary Transformers

2500 K.W. Mercury Arc Rectifier and Transformer

both supplies fail, then both batteries are automatically paralleled to supply the supervisory requirements, and when either or both of the supplies is restored the corresponding motor generator starts up and proceeds to charge both batteries. When the batteries are fully charged, one battery is put on trickle charge and the other is kept as a standby, restoring the conditions before the interruption. The particular motor generator set required to be normally running is selected by means of a key mounted on the battery-charging switchboard. Energy for the normal lighting of the control rooms is obtained from an auxiliary A.C. supply from the adjacent sub-station. A small amount of energy for emergency lighting is taken from the batteries, should the normal lighting supply fail.

The conductor rails are of the Southern Railway Company's standard type, and weigh 100 lb. per yard run. Normally, the rails are in 60ft. lengths and are bonded together by four copper bonds having a total cross sectional area of 1·6 square inch. The negative traction circuit is provided by the running rails, which for this purpose are bonded together at each rail joint by two protected type copper bonds, with an aggregate cross-sectional area of 0·332 square inch. Stranded bonds are used on joints and crossings and also to form cross bonds between the running lines. In certain cases negative cable is also used for this purpose. Sections of the conductor rail are isolated by means of hook switches which are provided between the feeders and the conductor rails. The switches are operated by wooden poles kept at strategic points, and are worked to the instructions from the control room supervising the area. Groups of high-speed circuit breakers are installed in certain areas, in small buildings at the side of the line, at points which are half-way between the sub-stations. These track paralleling equipments are utilised to take advantage of all the cross-sectional area of the conductor rails.

The rolling stock for the passenger services on the extension is of three kinds :—(*a*) For the local stopping services, two-car motor units of non-corridor stock, 8ft. 0½in. wide ; (*b*) for the semi-fast services from London, two-car motor units of corridor stock, 9ft. wide ; (*c*) for the fast services from London, six-car motor units of corridor vestibule stock, 9ft. wide. The two-car non-corridor units for these services consist of one motor car and one driving trailer car, and thirty-three such units have been provided. They have been constructed in the company's workshops by the conversion of steam stock bodies to suit electrical working, and have been mounted on new underframes and bogies. The units are equipped with standard Southern Railway suburban stock electric traction equipment. Compartment heating has been improved by the use of a new tubular type heater, two of which are provided per compartment, one under each seat. The heaters are in separate circuits, so arranged that one or both heaters may be on, as required. The two-car corridor units for these services consist of one motor car and one driving trailer car. Ten units have been built in the company's workshops and they are new throughout. Each coach of the unit is provided with a corridor, but there is no vestibule connection between the cars. The electric traction, lighting and heating equipment is similar to that of the two-car non-corridor units for the local services. A constant supply of hot water is provided for each wash basin in the lavatory compartment on each car from an electrically heated thermostatically controlled storage type of water heater. Each of the two types of two-car unit is provided with two totally enclosed 275 h.p. motors, mounted on one motor bogie per motor car.

The six-car corridor units for the fast services are formed of two corridor saloon type motor cars, between which are coupled two corridor third-class cars, one corridor first-class car, and one corridor buffet car. The vestibule connections between the cars afford continuous communication. Seventeen such units have been provided for this extension, and they are new throughout, the all-steel motor cars having been built by contractors, and the trailer cars in the company's workshops. The electric traction equipments are similar to those of the express stock in operation on the Brighton line, with electro-pneumatic control gear mounted on the underframes and two totally enclosed 225 h.p. motors mounted on each motor bogie, there being two such bogies per motor car. The passenger compartment lighting is supplied at 70 volts from motor generator sets, one of which is carried under each motor car. Nife emergency lighting batteries of sufficient capacity to provide the full lighting of the train in the event of main supply failure are also carried on each motor car.

As has been the case with all the recent electrification extensions of the Southern, the conversion scheme was prepared and carried out under the direction of Mr. Alfred Raworth, the company's electrical engineer for new works. All the civil engineering works undertaken in connection with the electrification have been carried out under the jurisdiction of Mr. George Ellson, the chief engineer. The rolling stock, apart from the electrical equipment, which has been Mr. Raworth's responsibility, has been produced by Mr. R. E. L. Maunsell, chief mechanical engineer.

The following contractors, manufacturing engineers, and other firms were employed on work in connection with the extension of electrification to Seaford, Eastbourne, and Hastings :—

Main Contractors.

Asea Electric, Ltd., London	33-kV switchgear, L.T. transformers, and supervisory equipment
British Insulated Cables, Ltd.	Rail bonds
British Thomson-Houston Company, Ltd.	Electric train control equipments and high-speed circuit breakers
Bruce Peebles and Co., Ltd.	Rectifier equipments
Doulton and Co., Ltd. ..	Rail insulators
English Electric Company, Ltd.	Traction motors
Estler Brothers, Ltd. ..	Track switches, hydraulic compressors, &c., and route indicators on trains
Macintosh Cable Company, Ltd.	Low-tension cables
Metropolitan-Vickers Electrical Company, Ltd.	Train control equipments
Pirelli General Cable Works, Ltd.	33-kV and pilot cables
Taylor, Tunnicliff and Co., Ltd.	Rail insulators
Birmingham Railway, Carriage and Wagon Company, Ltd.	Motor coaches
Metropolitan-Cammell Carriage, Wagon and Finance Company, Ltd.	Motor coaches

Sub-contractors.

Chamberlain and Hookham Company, Ltd.	kWh meters
Elliott Brothers, Ltd. ..	Indicating meters
Chloride Electrical Storage Company, Ltd.	Batteries
Edmundsons Electricity Corporation, Ltd.	Lighting and power installation
Parmiter, Hope and Sugden, Ltd.	Auxiliary A.C. apparatus and enclosed type fuses
Rosser and Russell, Ltd. ..	Heating and ventilating equipment at Ore control room
Westinghouse Brake and Signal Company, Ltd.	Rectifiers for the remote control apparatus and brake equipment and compressors for rolling stock
Korkoid Decorative Floors	Flooring, Ore control room
W. T. Glover and Co., Ltd.	Train equipment cables
Pritchett and Gold and E.P.S. Company, Ltd.	Nife emergency train lighting batteries
W. M. Still and Co., Ltd..	Coffee machines
Anti-Attrition Metal Company, Ltd.	Motor bearings
General Electric Company, Ltd.	Lighting equipment
Simplex Electric Company, Ltd.	Conduit
W.T. Henley's Telegraph Works Company, Ltd.	L.T. sub-station cables
Benjamin Electric, Ltd. ..	Lighting fittings
Tok Switches, Ltd.	600-volt switches
Slydlok	L.T. fuses

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

HIGH-SPEED TRAINS AND VIBRATION.

SIR,—That the higher speeds many trains now run at on the railways of this country have set up special problems is patent to all who travel on them. That they are proving very difficult to solve is also clear to those travellers, for they find the same or similar stock running to-day with the same characteristics as in the beginning, and no one can claim for a moment that such a quality of running is satisfactory to those who have made English railway travel the best in the world.

What is the outstanding characteristic ?

It is, probably, severe periodic vibration at certain critical speeds. The continued relatively violent cross swing at such criticals is sometimes alarming, always disagreeable, and when in a dining-car actually annoying, when your soup leaves the plate when its oscillations are in phase with the vehicle. It cannot, one supposes, be dangerous, or the railway people would not allow it to continue. Below the critical the coach is steady, and similarly above it.

Now, in other mechanical elements subject to such criticals, such as engine crank shafts, the critical is rushed through as quickly as possible, or a device is attached to the shaft to damp out the vibration promptly. In a railway train one finds that the critical speed may be passed for the various conditions of track resistance, but it cannot be quickly passed through, and to run slower means to fall behind the time schedule.

The problem is rendered more difficult by the fact that there are so many periods to take into account. First, there is the bogie itself, from the reaction of its wheels on the rails, then the suspended coach body which vibrates and swings under the bogie movement. The coach has, apart from its natural period of vibration as a whole in either plane, a bending swing from end to end, and so on. There are other factors.

Up to now this complicated problem has been met by a nice selection of helical and leaf spring suspensions, though even in this solution there is no general rule, and American practice with the coil spring first and the leaf second is the opposite to what is usual in this country. But for the cross swing itself something more seems required.

Whether new types or designs have sufficiently emerged is not yet clear. At any rate, one striking enough to solve it on different lines has not appeared, for the new streamlined trains still seems to have the same methods as in the past.

If all vibration were to spring from the bogie action (which it doubtless does not) then complete isolation of the bogie from the coach body would seem the line to follow. In such a system the body would float, as it were, on the bogie, supported by some frictionless device, so that, in action, movement of the bogie would not drag the coach body after it, later to be resisted, and so start its objectionable oscillation.

It might be said that the present arrangement has very little friction; but has it in actual fact ? Is not the apparent lag due to this ? However, if the friction is low, the checking of the bogie movement is brought about from the body itself and the reaction thus set up sets it moving on its swing.

In one support system a nest of large rubber balls is used in between the body and the bogie. Some considerable improvement might be expected, but in this case the reaction still affects the body, and unless damping is provided starts it in motion. With this system, however, a hydraulic damper is always fitted.

If the reaction of the bogie is not to be felt on the body how is it to be controlled ? From what basis ? Must not some damping device be introduced ? In the new high-speed train in the United States—"The Comet"—it is said that the two sets of springs are of the coil type, and a hydraulic damper is used ; but this would not appear to act sufficiently for the cross swing. On this train a bridge-like tubular car frame is used, stiffer against body vibration than the standard frame. Such a built-up type has already been satisfactorily tried out by Kruckenburg in Germany.

It is interesting to think of the action of the isochronous spring governor in this matter. Such governors are made practically frictionless, but are quite unstable. They will respond to the full range for a small variation or agitation in speed of a revolution or two. With this instability they hunt badly up and down, or to and fro, so as to render them useless. Does the railway coach hunt with its persistent side swing for the same reason or from friction lag ? At any rate, the governor is made into a useful device and the hunting checked by a properly fitted damping attachment called a dashpot.

It is interesting to note that in German experiments on the bogie itself, the nosing, which may start some of the trouble, was cured by reducing the coning of the wheel tires.

The vibration in the body has so far been overcome only by the old method of a careful selection of spring combination, and many vibration diagrams taken from coaches in different conditions have not induced the authorities to change their opinions.

It is too big a subject to be covered by these few remarks, and has too many factors, in the state of the track, rail support, nearness of sleepers, joints, accuracy, &c., and the vertical vibration so often absorbs the main problem, &c.; but if the higher speeds of 100 miles per hour are to be run, something better than now exists seems to be called for, particularly for the cross swing.

Altogether the problems of the high-speed train, quite apart from its streamlining form, type of power unit, &c., are no light ones to solve satisfactorily.

June 24th. HIGH-SPEED FAN.

THE DOUGLAS SOCIAL CREDIT SCHEME.

SIR,—Dr. W. H. Coates has scored some clever debating points over Major Douglas, but your readers will appreciate that Major Douglas himself has not been accorded a hearing in your columns.

The theory of Social Credit, it appears, is to be discredited because of an alleged inability on Major Douglas' part to comprehend the existing economic system. One could never guess that the directors of the present system had pleaded guilty to the same offence, and even to executive action which has brought the gravest economic consequences. I refer, of course, to Mr. Montague Norman's admission that he understands nothing as to first causes, but that he does his best ; and to Sir Basil Blackett's even more candid confession, "When I think of what we have done with money and what money has done to us, I think we are all fit for a lunatic asylum."

So Douglas errs in good company, and by Dr. Coates' reasoning the existing financial system stands equally condemned with the Douglas Social Credit system. The fact is Dr. Coates' economic "background" is so incompletely portrayed as to be misleading.

There is no hint that post-war trade depression is largely due to, and certainly aggravated by, the operations and mistakes of "sound finance," that all the parties responsible for the post-war return to the Gold Standard have since admitted it to have been the most disastrous mistake, that our money system is patently incapable of supplying human needs or even of distributing plenty, and that statesmanship is subordinated to financial deals.

Year ago, Sir Oliver Lodge wrote : "There is enough and to spare for all, if we would but sit down at the board like gentlemen, instead of snatching." The truth of this statement has been strikingly borne out by the colossal

sabotage and restriction of real wealth in recent years, and the sequel is to be found in the alarming spread of malnutrition, affecting ten million souls in this country alone—according to Sir John Boyd Orr, of the Nutrition Committee—and the incidence of the great derelict areas.

The issue, then, is between an ordered economy based on scientific principles, and the present anarchy of vested interests struggling to appropriate to themselves the rewards of the industry of others, reckless even of the destruction of whole industries, and of the increasing toll in human lives and health. To the clarification of that very real issue Dr. Coates contributes nothing.

Lymington, Hants, June 23rd. H. C. KING.

[In his first paragraph Mr. King says: "Major Douglas himself has not been accorded a hearing in your columns." To prevent any hasty misjudgment of our actions, we wish our correspondents to know that we invited Major Douglas to contribute an article as a basis for Dr. Coates' examination. He declined to do so, as he was going abroad, but said that his "Monopoly of Credit" might be taken as expressing his views. That book contains the minutes of his evidence before the Macmillan Committee and his Tokyo (W.P.C.) paper. We trust that our correspondents will note this fact and admit that we have not been so unfair to Major Douglas as Mr. King's first paragraph seems to suggest.—ED., THE E.]

SIR,—Dr. W. H. Coates follows along the lines of many orthodox economists, and the conditions of to-day do not suit his theory.

He errs, I think, when he tells us that because goods could be made without the application of money then money is of secondary importance, and he goes on to labour that point. He surely should consider that the importance of money rests on the conditions of to-day and not on the hypothetical case of the non-existence of money. To every manufacturer the object, and rightly so, is profit, and the stagnation of industry and consequent unemployment has arisen only in those countries where restriction of credit by a deflationary policy has been set up.

America's boom was based by expansion of credit on maintenance of price levels and her collapse based on drastic deflation, which was entirely unwarranted, considering that foreign creditors were negligible. It is important, too, to mention that price levels did not change in eleven years.

And yet Dr. Coates would tell us that the money system is unimportant. To-day, when conditions of plenty exist, the money system makes or mars the country and, more important, the average man.

Dr. Coates, too, makes a point that credit cannot be expanded beyond certain limits. He is assuming gold standard conditions that most of the world has rejected as unsuitable for conditions of industrial expansion. Why tie one's monetary expansion to a metal of which the quantity raised is ridiculously small compared with industrial expansion requirements? Our exchange values should be based on the cost of living in the country and the natural tide of trade will keep the values correct automatically.

Dr. Coates thinks from the physical standpoint, not the monetary one, and assumes automatic relations between price and demand. The deflationary policy of this country causes a continuous and sometimes rapid fall in prices, and the lag between costs and prices results in great hardship on many industries, to safeguard the interests of which price rings, restriction rings, and monopolies are formed.

The Robinson Crusoe conditions for Dr. Coates' economics are then not with us. D. E. DYAS.

Shrewsbury, June 20th.

SIR,—I hope that an article will be written in reply to Dr. Coates' articles in your issues of June 14th and 21st.

Meantime while I have no intention of arguing Douglas, if for no other reason than ignorance, I cannot help feeling that there is a lot of special pleading in Dr. Coates' contribution.

Disregarding Douglas entirely, it is quite obvious that there is a tremendous unsatisfied demand for goods. Dr. Coates admits this. The point is that by no stretch of imagination can that demand be met under the present system of finance, owing, among other reasons, to the elimination of labour by the machine and its effect on the purchasing power of the individual. This seems a fact that must be paid attention to when discussing Douglas. Dr. Coates, I regret to say, dodges the issue.

It appears so clear that the present state of affairs became inevitable when the first labour-saving appliance came into use, unless some compensation was conceived and applied at the same time. What distresses so many is that men, accustomed in their everyday scientific life to apply correction and compensation to such matters, treat similar monetary problems as if they had their origin in Divine inspiration, and must last for all time. Douglas, on the contrary, suggests a method of compensation for a proved defect in the world accountancy system.

It matters little to me, and I venture to say to any of us who resent, and abhor, the present state of financial affairs, whether Douglas's system or that put forward by anyone else is adopted. In fact, we feel that Douglas himself is less interested in the means than the end. What we want, and I venture to believe that the increasing intensity of this demand is on a par with the rate of increase of world indebtedness (I believe, incidentally, that the latter is as the fourth power of time), is a remedy for the disease, and so far Douglas seems to be the only doctor who can prescribe. We know that the rate of elimination of labour is only limited by the necessity of deciding what is to be done with the people displaced. Is it to be the enjoyment of leisure or the lethal chamber? Does Dr. Coates really believe, as a scientist, that gold is a necessity? I say "as a scientist," as, of course, a shareholder in gold mines, a manufacturer of machinery for extracting gold, a maker of explosives, or a farmer providing food for mine workers, &c., couldn't be expected to approve of its elimination.

In view of the way Dr. Coates refers to the gold question it would appear that he cannot conceive doing without it. To my way of thinking nothing damns the present monetary system more than the shibboleths surrounding the use of that metal. Surely the fakes and wangles recently perpetrated before our eyes reduce gold in monetary matters to the level of a music hall turn.

Dr. Coates' articles seem peculiarly vulnerable, but even if he succeeded in disproving Douglas he has only done that, and has not added one iota to the solution of the great problem.

In fact, he seems more concerned to protect the existing order of things, by attacking one proposed solution of the problems, than in agreeing that the disease is there and needing a remedy, but objecting to the remedy.

As an engineer I find it impossible to believe that a monetary system which has gone on for centuries with little change ought to exist to-day, and be defended by people whose everyday work is to make each new discovery obsolete by a newer one in the shortest possible space of time. Surely to try to make one believe the present system is final is an insult to our intelligence?

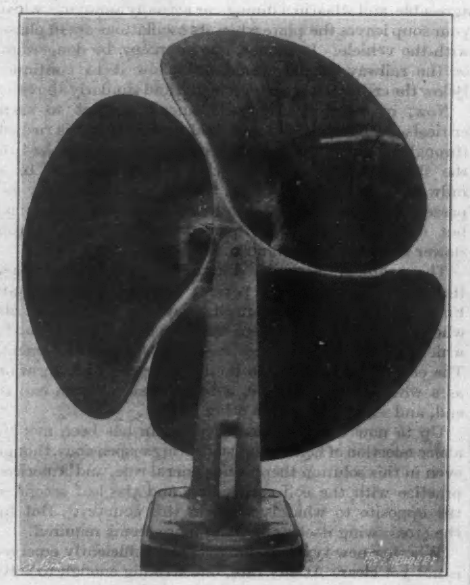
In short, the system at present in use is not working, cannot work, and must be superseded. The trouble is that, as in the days of the Inquisition, the torture chamber and the glare of the fire made it difficult for all but the strongest to hold fast to their faith, so nowadays the thought of the job or the bank overdraft, and the possibility of financial martyrdom, make those who might otherwise speak out prefer to "mind their step."

June 23rd. K. W. WILLANS.

THE PROPELLERS OF THE "NORMANDIE."

MESSIEURS,—Dans son numéro du 14 courant (page 624), THE ENGINEER publie une photographie d'un des quatre propulseurs du nouveau paquebot "Normandie." C'est un propulseur à trois ailes, ayant un pas variable et une fraction de pas d'une importance inusitée.

Voulez-vous nous permettre de faire remarquer, à cette occasion, que, dans le domaine technique comme dans bien d'autres, il arrive à l'histoire de se répéter? Le propulseur du "Normandie" évoque d'une façon saisissante le



premier des huit propulseurs essayés successivement sur le premier navire à hélice français, le "Napoléon," dénommé plus tard le "Corse." Ce propulseur, dû à la collaboration d'Augustin Normand et de John Barnes, avait, lui aussi, trois ailes, d'un pas variable et d'une grande fraction de pas. Il fut essayé aux sorties des 25 et 26 janvier et 14 février, 1843. Nous vous envoyons, ci-joint, la photographie d'un modèle qui en fut fait à cette époque.

CHANTIERS ET ATELIERS AUGUSTIN NORMAND,
L'Administrateur Délégué,
Le Havre, 19 juin. A. AUGUSTIN-NORMAND.

American Labour and the Wagner Bill.

(By a Correspondent.)

BEFORE dealing with the Wagner Bill, it seems desirable to present a short summary of the present rather complicated position of American labour, with particular reference to the working of the N.I.R.A. That Act was largely intended to improve the status of labour and stimulate the growth of national trade unionism—as distinct from that of company unionism to which the national movement is opposed. But the increase in extent and bitterness of trade disputes the last year or two, though in some sense it might indicate growing strength of trade unionism, actually reveals inherent weakness and heterogeneous disunity. In the first place, the great majority of American workers, nearly 80 per cent., are not in any union, about 2·5 per cent. are in unions not attached to the American Federation of Labour, 12·5 per cent. are in unions affiliated to the Federation, and 8 per cent. are in company or plant unions. These latter are individualistic company unions, strongly supported by the employers. The National Recovery Administration has had little or no success in reconciling the diverse and conflicting elements represented by these figures, and the high hopes at first entertained by organised labour (excluding plant unions), based on the apparently improved status given in the famous Section 7 (*a*), have been disappointed, with consequent growing bitterness against the Administration. The temporary increase in membership of the unions has more than faded out, and the great majority of unskilled workers outside the unions have remained indifferent. The American Federation of Labour, aloof and exclusive and limited in outlook only to the skilled workers, has little real influence, and has incurred the open hostility of the employers and also of the plant unions. The Courts, especially the Supreme Court, in such cases as have come before them, have not strengthened the hands of the Government, and so far as one can judge from the present welter the employers and company unions are emerging stronger than ever and may before very long dominate the position.

Most of the recent disputes have centred around the refusal of employers or associations thereof to recognise trade unions, even though the "yellow dog" contract, which made non-unionism a condition of employment, was made illegal in 1932. But in some cases trouble has arisen because the skilled workers were not satisfied that their rates of wages had been properly adjusted to increased costs of living, and there were several other sources of bitter controversy in the varied application of the codes.

There was at first a distinct one-sidedness in the constitution of the code authorities, though this was afterwards remedied by the inclusion on those bodies both of labour and consumer advisers. The complicated machinery for dealing with labour disputes became still more complex under the N.I.R.A., with its Industrial Relations Committees in each industry; the National Labour Board—soon to be superseded by the National Labour Relations Board under the chairmanship of Senator Robert F. Wagner—the State Compliance Director, and many others, including, in the last resort, the President himself, whose intervention has had so frequently to be invoked. In addition, the Federal Department of Labour has always had fairly wide powers in these matters. These various bodies were for the most part adjustment agencies. The enforcement agencies, namely, the Courts, were not called upon more than was absolutely necessary. Generally, it may be said that the principle of self-government by industry rather than Government regulation has been so far as possible consistently kept in view. In practice it has proved overwhelmingly difficult.

As a result of his experience on the above-mentioned Board, Senator Wagner has, for the second time, brought in a Bill with the aim principally of strengthening the position of organised labour and facilitating collective bargaining between workers and employers. More specifically, and with this principal object in view, the Bill provides for the creation of a National Labour Relations Board with wide powers, the abolition of company unions, the enforcement of the doctrine of majority rule in collective bargaining, and the status of legal authority in the voluntary arbitration awards given by the Board. There can be little doubt that any attempt to abolish or outlaw the company unions will be strenuously resisted by the employers and probably by many of the workers themselves. It appears also that the intention of the Wagner proposals is to make the American Federation of Labour the nucleus around which the forces of unionism must gather and be strengthened and developed to a vastly greater extent than has hitherto been possible. The attitude of the Federation itself and the views lately expressed by its President, Mr. Wm. Green, give colour and plausibility to this view. In such event the power of the Federation—financially, socially, and politically—would be very great, and the opinion has, indeed, been freely expressed that the Federation's powers would be excessive and dangerous, and that it would be in a position to dominate all social and economic and most political issues. From the point of view of finance alone, it is indicated that its income from members' subscriptions would be in the neighbourhood of 400 to 500 million dollars per annum, if membership of the Federation or its affiliated unions became generally compulsory for both skilled and unskilled workers.

It seems unlikely that such a consummation would be reached, or even that any considerable progress will be made in general trade unionism. Inertia, conservatism, individualism, are all arrayed against fundamental changes in labour mentality or appreciable advance towards unity and co-operation. Also, the employers and the company unions, as already intimated, appear to be emerging stronger than before. And, in addition to all this, there is the great body of moderate opinion—that of the scientific, professional, and managerial classes—which clearly perceives the dangers of labour domination and of any great increase in the powers and prestige of the American Federation of Labour. Finally, there are the serious and almost insurmountable difficulties of vast areas, and distances, remoteness, the wide disparity, for instance, between North and South, between the agricultural and highly industrialised districts, and the lack of any strong, far-sighted and intelligent leadership capable of knitting together into enduring homogeneity the wonderfully diverse and conflicting elements of the American working class.

A FLYING-SCHOOL and aerodrome for the Royal Air Force is to be established at Church Fenton, near Leeds. Some 260 acres of land have been acquired and negotiations are proceeding for the purchase of adjoining land. Land is also being acquired for an air base on the shores of Luce Bay, near Stranraer.

Rail and Road.

AN engine of unusual design will shortly be making its appearance on the main line of the L.M.S. Railway. She is a turbine locomotive, and has been constructed at Crewe. Her number is 6202, and, with a 4–6–2 wheel, she ranks as an engine of the "Princess Royal" class.

ANSWERING a question as to the reconstruction of weak bridges the Minister of Transport said on June 19th that during the last two financial years schemes for the reconstruction of 129 bridges in private ownership were approved for grant. During the current financial year he had already been advised of schemes for the reconstruction of 242 other bridges which were to be put in hand during the current financial year.

IN reply to an inquiry on June 17th as to whether the Government would give some form of financial support to transport schemes in Scotland, the Financial Secretary to the Treasury said that the Government would be ready to consider any sound scheme similar to that of the L.P.T.B. if it was laid before them. The money resolution in connection with the latter was passed by the House of Commons on Friday, June 21st.

STILL more streamlined railcars are to be placed in service on the Great Western Railway. As the result of a recent order received from that company, the Associated Equipment Company, Ltd., Southall, Middlesex, will shortly begin the construction of a further ten oil-engined railcars. The new railcars will be fitted with twin A.E.C.-Ricardo engines and twin gear-boxes, and will be, mechanically, the same as the three units scheduled to begin running in the summer services on July 8th, except that they will embody certain minor improvements. One new feature will be the inclusion in each car of a lavatory compartment. Another car, intended for experimental service, will have a special parcels van body. It is probable that the first of the new units will be ready for service in October, and at the end of the year the G.W.R. will have seventeen streamlined railcars in active commission.

THE possibility of building a bridge across the Severn, some distance below Gloucester, has recently been the subject of correspondence between the Gloucestershire County Council and the Ministry of Transport. Mr. Hore-Belisha has now informed the Council that he is in a position to promise a 75 per cent. grant from the Road Fund towards the cost of a preliminary survey and report. The object of the survey is not to examine any particular site, but to make a general study of the problem from a geographical and engineering point of view. The construction of such a bridge would shorten very considerably the distance by road between London and South Wales, besides facilitating communication between the counties on opposite sides of the river. There is at present no road bridge below Gloucester, and traffic between Bristol and Cardiff must either use the ferry or make a long detour.

SUSPICIONS were created in the public mind when, on Thursday, June 20th, it was announced that Colonel Mount had held part of his inquiry into the Welwyn Garden City collision of the 15th in private. That was done, as we have explained on previous similar occasions, for the protection of those men whose action or inaction may have contributed to the accident. The inquiry is not a court of law, but is held, under the Act of 1871, to ascertain the cause so that steps may be recommended to guard against a future similar mishap. By giving their evidence in private they talk as freely as before the railway officers, knowing that advantage will not be taken of any frank statements which otherwise might lead to criminal proceedings for neglect. For the same reason, as instanced after the Port Eglinton Junction accident last September, the Inspecting officer's conclusions are not published until any criminal proceedings are concluded or abandoned.

THE facilities offered by the Government towards carrying out the electrification of the former Great Eastern Railway, the construction of new tube railways, and the undertaking of engineering works on the former Metropolitan Railway, has evidently inspired anticipations as to further electrification on the Southern Railway. It is thought probable that the electrical operation that now terminates at Guildford will be carried the further 44 miles to Portsmouth, especially in view of the growing traffic for the Isle of Wight. The present electrification to Guildford branches off the main line at Surbiton and goes by the minor and longer line through Effingham Junction. It would thus be necessary to convert the direct route through Woking. It was announced, when the extension of electrical operation to Worthing was ordered, that it might later be carried on to Chichester and Portsmouth. For a satisfactory use of that line for a London-Portsmouth service the line between Dorking and Ford Junction would also have to be done. But the route through Horsham would then be 87¾ miles as against 74¼ miles through Guildford.

THE buckeye coupler which, as related elsewhere in our report of Colonel Mount's inquiry, figured so prominently in the Welwyn Garden City collision of June 15th, was first definitely mentioned in an accident report after the collision of September 6th, 1915, at Newark, Great Northern Railway, when the eleven vehicles on the 5.45 p.m. express from King's Cross to Leeds all remained upright except the seventh. It was said that the strength of the coupling kept the carriages connected together, one behind the other, in a more or less direct line and prevented any tendency for one or more to get broadside on to the others and for the underframe of one car to ride over that of the next to it, resulting in one telescoping into another. The Laycock buckeye coupler was also mentioned by name in the report on the Aln derailment of December 19th, 1917, owing to a broken axle on the third coach out of sixteen vehicles. It was said that the remainder of the train behind the fourth vehicle was on the rails, and all the couplings were intact. Although the fact was not mentioned, the buckeye coupler no doubt contributed to, in each case, derailed vehicles remaining upright after the derailments of September 13th, 1913, at Chevington, of December 21st, 1914, at Littleburn, and of May 19th, 1916, at Scremerston.

Miscellanea.

WE regret to announce the death, on June 18th, 1935, of Mr. George Harlow, of the Metropolitan-Vickers Electrical Company, Ltd. Mr. Harlow was the manager of the company's plant sales department and also for some years director of the Metropolitan-Vickers Electrical Export Company, Ltd.

WORK has commenced on the canal which is to convey water from the Zambezi River above the Victoria Falls to the power house to be constructed by the Victoria Falls and Transvaal Power Company immediately below the falls. A fall of about 365ft. will be utilised and the plant will supply current to Livingstone and other points in the vicinity.

ACCORDING to preliminary figures compiled by the United States Bureau of Mines, the total world production of coal of all kinds in 1934 amounted to 1,267,000,000 metric tons, an increase of 95,000,000 over that in 1933. Of the 1934 production, 184,000,000 tons of the total was lignite and 1,083,000,000 tons was bituminous and anthracite.

THE Royal Society of Arts Albert Medal for 1935 has been awarded, with the approval of the President, H.R.H. the Duke of Connaught, to Sir Robert A. Hadfield, Bart., F.R.S., "for his researches in metallurgy and his services to the steel industry." The Society's Albert Medal is awarded annually "for distinguished merit in promoting arts, manufactures, or commerce."

ACCORDING to a note in the *Electrician*, Monsieur Léon Damas, of Charleroi, assisted by Professor Baethelmans, of Charleroi, has invented a television broadcasting system, by which, it is claimed, sound and image are transmitted on the same wave and perfectly synchronised. It is also stated that the natural colours of the televised object are exactly reproduced on the screen.

THE Institution of Sanitary Engineers informs us that, owing to its increasing membership and the extended activities of the Institution, the Council has decided to take larger offices, and that it is hoped to move into new premises at 118, Victoria-street, S.W.1, before the autumn session. Accommodation will be provided for a members' room, a library, and a reading and writing room.

THE first annual report of the Irish Free State Industrial Research Council states that investigations have been commenced to find the possibilities of producing substances such as wax, artificial silk, and industrial alcohol from peat. It is known that by laboratory methods a wax somewhat similar to montan wax can be obtained from peat, and research is now in progress at University College, Cork, into the possibilities of developing a commercial process for extracting from peat waxes suitable for industrial purposes.

AS a consequence of the popularity of the wireless telephone service between South Africa and Great Britain, it has been decided to increase the existing facilities in South Africa by the provision of a new high-power short-wave telephone transmitter of the Marconi S.W.B.9 type, which will be installed at Klipheuvel. The receiving station at Milnerton will also be enlarged to cope with the new traffic, and the new "international" type of Marconi receiving equipment, with inverter gear to enable secrecy of communication to be maintained, is being added to the installations already in use.

A FULLY automatic three-dimensional form-cutting and die-sinking machine, which presents features of unusual interest, has been developed by London Electronics (Machinery), Ltd., and is described in a note in *Machinery*. The movement of the cutting tool is controlled from a master, cast in a special transparent material. A fixed narrow beam of light passes through the master on to a photo-electric cell, and every variation in the intensity of the light transmitted is reproduced electrically by the cell. The small varying current in the photo-cell is amplified sufficiently to operate an electro-magnetic control for the depth of cut of the tool. The master, together with the blank to be machined, is carried on a vertical slide, arranged for movement in both horizontal and vertical directions. In this way the beam of light is caused to pass successively through every part of the master, the form of which is reproduced by the cutting tool.

A NEW type of regeneration process for waste vulcanised rubber that is acquiring increasing commercial importance, both in this country and in the United States, is of distinct interest to the chemical trade, in that it produces appreciable quantities of zinc sulphate as by-product, states the *Chemical Trade Journal*. The process is especially adapted to the treatment of scrapped motor tire covers which usually contain about 10 per cent. of zinc oxide in addition to up to 30 per cent. of carbon black. The process is a three-stage one. In the first stage the waste rubber is de-vulcanised and plasticised by thermal treatment; in the second stage, the actual rubber, softeners, accelerators, and anti-agers are removed by a special solvent leaving a residue of carbon black and zinc oxide; in the third stage, this residue is leached with dilute sulphuric acid, leaving the carbon black available for re-use and giving a solution from which the zinc sulphate heptahydrate can be recrystallised.

THE Czecho-Slovak Post Office has placed an order with the Marconi Company for the supply of a high-power short-wave telephone and telegraph transmitter for installation at Podebrady, near Prague. This transmitter will be used primarily for broadcasting for the benefit of Czecho-Slovaks who are resident in distant countries and for spreading a knowledge of Czech and Slovak culture. For this service three Marconi series-phase aerials will be provided, and the carrier energy of the transmitter will be 35 kilowatts. For general telegraph communication, the transmitter will be capable of a high-frequency output of 56 kilowatts, and for this purpose three omni-directional Marconi uniform aerials will be used. The wave range of the transmitter is from 14 m. to 100 m., and quick wave-change arrangements are provided which enable the almost instantaneous selection of any of four spot waves. A valve drive with a precision of 1 in 20,000, at any frequency within the above wave range, will be used to stabilise the transmission.

Air and Water.

A NEW air service between London and Brussels *vid* Ostend has been opened by Hillman Airways.

A REPORT by Monsieur Henri Bouché on the economic position of air transport in Europe has been published by the Communications and Transit Organisation of the League of Nations.

THE first motor tanker to the "Arcform" design built in the Netherlands was recently launched at Rotterdam. This vessel is also the largest tanker yet built in that country.

FROM July 1st a twice-weekly air mail service will be in operation between Europe and South America, as a result of co-operation between Deutsche Lufthansa and Air France.

AN aerial train comprising seven gliders drawn by one aeroplane is to make a thousand-mile trip in the U.S.S.R. from Tula to Rostov. A supply of fuel is to be carried in one of the gliders, and the aeroplane will refuel in mid-air by means of a tube.

IT has been stated in the Dail by the Irish Minister for Industry that an experimental air service between Great Britain and the Irish Free State will be started next month in order to obtain the necessary technical information for a permanent air service between the two countries.

THE world's long-distance non-stop flight record has been broken by a French flying boat which recently flew from Cherbourg to Zinguichor, Senegal, a distance of 2685 miles. The machine, named the "Croix du Sud," is a "Latecoère" flying boat having four 650 h.p. Hispano-Suiza engines fitted with variable-pitch propellers.

HAVING completed the survey of Pan American Airways' new base at Midway Island in the Pacific Ocean, the seaplane "Flying Clipper" has started the return journey to the United States, *vid* Honolulu. It is intended that the machine shall "fly blind" to Honolulu to ascertain its performance under the worst possible visibility conditions.

THE work of shortening the fore and main masts of the "Mauretania" has been completed, and the vessel is now practically in readiness to begin her last voyage from Southampton to Rosyth. The masts were shortened by some 40ft. in order that the ship may pass easily under the Forth Bridge. The journey to Scotland is expected to take about thirty-six hours.

SUBJECT to the approval of the Ships Replacement Committee, appointed to consider schemes under the "scrap and build" subsidy, Sir Robert Ropner and Co., Ltd., are going to place an order for a 9000-ton motor cargo vessel with W. Doxford and Sons, Ltd. To comply with the subsidy requirements the company proposes to scrap three 6000-ton vessels.

THE Australian Federal Ministry is considering plans for the use of certain air routes for all first-class air mail matter at an ordinary rate of 2d. per ounce. Daily services between Brisbane and Sydney, Sydney and Melbourne, Melbourne and Adelaide, and Melbourne and Hobart are suggested, with a twice-weekly service between Adelaide and Perth. The services will be let by tender to private operators.

ACCORDING to information received by the *Journal of Commerce*, the Japanese Government has fixed the amount of the shipbuilding subsidy between 24 and 32 yen per gross ton of new tonnage up to the total extent of 50,000 tons. This will be paid to shipowners who scrap a slightly higher tonnage of obsolete vessels of over twenty-five years' age. The new vessels must not be under 4000 tons, and must have a reasonably high speed.

THE owners and master of the Newcastle steamer "Usworth" were completely exonerated by the Court of Inquiry into the loss of that vessel, whose findings were recently promulgated by Lord Merrivale, the Wreck Commissioner. The master, he said, did everything he could to save the vessel, and was justified in ordering her to be abandoned. The owners had complied with the statutory and administrative regulations. The "Usworth" was overwhelmed by the sea and foundered in a hurricane.

THE trophy representing the mythical "Blue Riband" of the Atlantic has been finished, and is to be presented to the owners of the Italian liner "Rex," who will pass it on to the owners of the "Normandie." The trophy is 3ft. high, and represents the terrestrial globe surmounted by two female figures, one of whom symbolises speed triumphing over the waves of the Atlantic. The Atlantic is shown in blue enamel, traversed by a narrow red line, the route of the Transatlantic liners. Four sailing vessels symbolise the winds. A winged victory bears the blue riband.

ACCORDING to the recently issued report of Monsieur Maurice Vincent, *rapporteur* of the French Parliamentary Committee of the Merchant Navy, the cost of constructing the "Normandie" was about £11,000,000. The annual charges assumed by the State in connection with the "Normandie" will impose upon the Budget a sum in the region of £1,200,000. This amount will decrease annually after the third year, and disappear at the end of twenty years. In addition to this, the Government has, in view of the difficulty of contracting a comprehensive insurance of the vessel, taken upon itself the entire portion of the uncovered risks.

AT the special meeting of the General Committee of Lloyd's Register of Shipping held on June 20th, Sir George Higgins was re-elected Chairman for the ensuing year, Mr. Arthur L. Sturge Deputy Chairman and Treasurer, and Mr. J. Howard Glover Chairman of the Sub-Committees of Classification. Sir John H. Luscombe, Mr. J. Herbert Scrutton, and Sir Kenneth S. Anderson, Bart., were re-elected as members of the General Committee, and Sir Andrew Scott was elected a member of the General Committee upon his retirement, on June 30th, from the position of Secretary to the Society, which he has occupied for over thirty-one years. Mr. Malcolm K. Scott, Assistant Secretary, was appointed Secretary in succession to Sir Andrew Scott, and Mr. A. J. Barwick, a Senior Clerk in the London office, was appointed Assistant Secretary.

RIVER THAMES IMPROVEMENTS

(*For description see page 660.*)

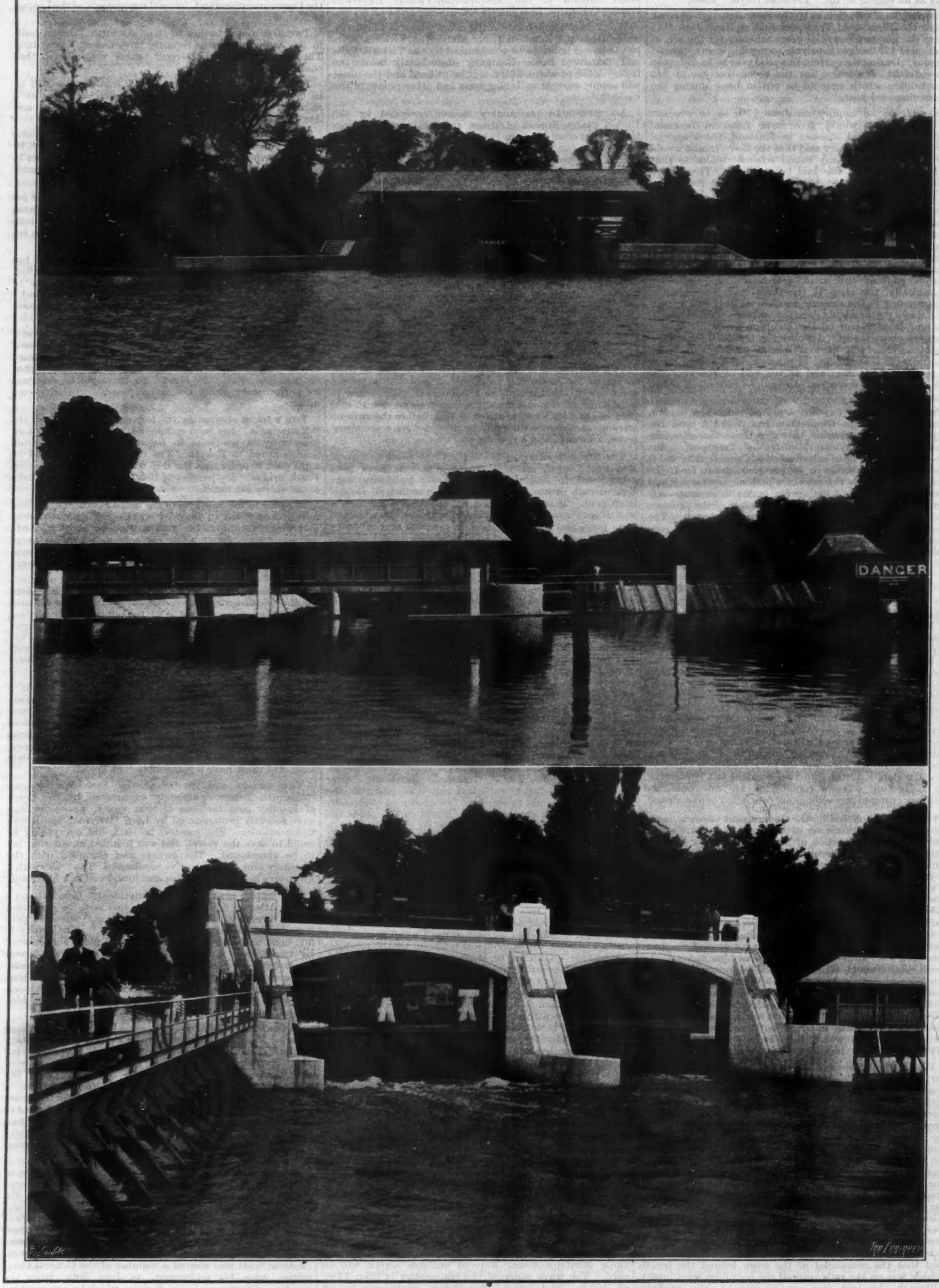


FIG. 14 (ABOVE):—UPSTREAM VIEW OF WEIR AT SUNBURY
FIG. 15 (CENTRE):—UPSTREAM VIEW OF SLUICES AT MOLESEY
FIG. 16 (BELOW):—ROLLER SLUICE GATES AT TEDDINGTON

The Engineer

JUNE 28, 1935.

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SIXTEEN-PAGE SUPPLEMENT—"THE METALLURGIST."

NOTICES TO READERS.

*** If any Subscriber abroad should receive* THE ENGINEER *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

*** For Subscription rates, see page 2 of Advertisements.*

*** All letters intended for insertion in* THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** No undertaking can be given to return drawings or manuscripts; correspondents are therefore requested to keep copies.*

CHANGES OF ADDRESS.

*** Will subscribers please note that in all advices regarding changes of address it is necessary to have* **both the old and new addresses,** *as our lists are kept alphabetically by towns. Advices of this nature should reach us by the first post Wednesday morning prior to the alteration.*

The Metallurgist.

THE JUNE NUMBER OF THE METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ANGLO-GERMAN NAVAL AGREEMENT.

ON Tuesday, June 18th, an exchange of Notes for the restriction of naval armaments was signed at the Foreign Office on behalf of Great Britain and Germany by Sir Samuel Hoare and Herr von Ribbentrop. It may be doubted whether in the modern history of diplomacy an agreement of such importance has ever before been negotiated so promptly, and, we might add, with so little fuss. Since the war the labours of mountainous conferences at Geneva and elsewhere have, as a rule, produced very small mice; the results, indeed, have, with rare exceptions, stood in inverse ratio to the magnitude of the effort. To this rule, the Anglo-German naval talks have proved a happy exception. They began in London on June 4th, when Herr von Ribbentrop, Germany's Ambassador at Large, accompanied by Admiral Schuster and Commander von Kiderlen, of the German naval staff, met in consultation at the Admiralty Vice-Admiral C. J. C. Little, Deputy Chief of Naval Staff, and Captain V. H. Danckwerts, Assistant Director of the Plans Division. The basis of the conversations was the intimation which Herr Hitler had conveyed to Sir John Simon, during the latter's visit to Berlin, that Germany had no desire to challenge the naval primacy of this country, and would rest content with 35 per cent. of the combatant tonnage of the British Commonwealth navies. In the circumstances, this was a reasonable offer, and the British Government lost no time in pursuing the matter further. Germany was invited to send delegates to discuss the question. On their arrival they were found to have brought concrete proposals which, under examination, were recognised as containing the germ of a definite agreement. In the ensuing talks, no fundamental divergence of opinion revealed itself. Only on subsidiary points was adjustment necessary. Progress under these favouring conditions was so rapid that when the discussion was adjourned for the Whitsuntide recess it was already clear that only some quite unforeseen hitch could delay an agreement. Fortunately that contingency did not arise. Herr von Ribbentrop returned to England with Herr Hitler's approval of the draft agreement, the substance of which was accordingly embodied in the British Memorandum of June 18th, confirmed by the German Note of the same date. Thus, in considerably less than a fortnight of actual discussion a complete accord was reached on what had threatened to become the thorny question of Germany's future strength at sea. Only goodwill and confidence on both sides could have produced such a remarkable result.

Except in so far as foreign policy should interest all good citizens, we are not greatly concerned with the political aspects of the new naval agreement. In our judgment, however, it cannot fail to exert a beneficent influence on our future relations with Germany, a country with whom the overwhelming majority of our people desire to live on amicable terms. The baneful effects of the Anglo-German naval rivalry of pre-war years are familiar to the most casual student of history. More than any other political factor of those times did it tend to excite suspicion and hostility. If at any date before the summer of 1914 a compromise could have been reached between London and Berlin on the naval issue, the subsequent world tragedy might have been, if not averted, at least circumscribed. Holding this belief as we do, we make no apology for welcoming the new naval compact as a definite step towards reconciliation and peace. Nor do we doubt that the foreign critics who, taken aback by the swift march of events, are admonishing Great Britain for daring to negotiate with Germany direct, will speedily recognise that what has been done is hardly less in their interest than in ours. Under the new agreement both France and Italy are assured, for an indefinite period, of a substantial excess of naval power over that of Germany. Is it conceivable that either one or the other would have secured that guarantee had Britain rejected the German overture and left, nay, provoked Herr Hitler to rebuild the German Navy on a scale comparable with that projected for the development of his land and air forces? Turning to the agreement itself, it establishes a ratio of 100 : 35 as between the British and German navies, not in global tonnage but in categories. Further, this ratio is to be a "permanent relationship, *i.e.*, the total tonnage of the German fleet shall never exceed a percentage of 35 of the aggregate tonnage" of all the British naval forces. The permanent character of the agreement is also emphasised in the German Note. Here, then, is no makeshift pact of doubtful duration, but a solemn engagement binding both parties for as long a period as human prescience can envisage. To the 35 per cent. ratio there is but one exception, viz., submarines. In this arm Germany asked, and was granted, equality with Great Britain, but "in principle" only. In practice she is at liberty to build up to 45 per cent. of our total in submarines, in which case the excess of 10 per cent. must be deducted from one or more of her other categories. The German Government, however, "reserves the right, in the event of a situation arising which in their opinion makes it necessary for Germany to avail herself of her right to a percentage of submarine tonnage exceeding the 45 per cent., to give notice to this effect" to the British Government and they "agree that the matter shall be the subject of friendly discussion before the German Government exercise that right." While it may seem anomalous for Great Britain freely to accept a German claim to almost half our tonnage in the one class of vessel that caused us the heaviest losses in the war, a moment's reflection suggests the practical impossibility of rejecting this claim. Since the war, every Naval Power, excepting Great Britain, has increased its force of submarines. France has no less than 111, Japan 69, Italy 67, and the United States 94 of these boats, against the British total of 60. The German claim to 45 per cent. of our tonnage cannot, therefore, be regarded as excessive. Even though Germany builds up to this full ratio her submarine flotilla will still remain the smallest among those of the Great Powers. If, on the one hand, we cannot forget the havoc wrought by Germany's submarine operations in the war, on the other, we should remember that her voluntary proposal to limit her future naval forces to little more than one-third of our own manifestly implies a desire for peaceful and amicable relations with this country. To question the German Government's good faith in this matter would be worse than churlish. Germany must, of course, be judged by her future actions, but unless and until she gives definite cause for suspicion it would be illogical to regard her submarines as more of a menace than those of other Powers. In determining the aggregate of British tonnage on which the 100 : 35 ratio is to be based, only vessels under the age limits were considered. As the official figures have not yet been published, it is inevitable that some uncertainty should exist as to the precise amount of tonnage which Germany may build in each category. We believe, however, that the figures given in a semi-official German newspaper last week are not far from the mark. According to these, Germany is entitled to 183,750 tons of capital ships, 51,380 tons of heavy cruisers, 67,270 tons of light cruisers, 52,500 tons of destroyers, and—if the 45 per cent. ratio is adopted—23,700 tons of submarines. Deducting ships already built or in hand, Germany is, therefore, at liberty to construct 133,750 tons of capital ships, 118,650 tons of heavy and light cruisers, 45,000 tons of aircraft carriers, 42,900 tons of destroyers and 20,700 tons of submarines. It is very improbable that all this construction will be undertaken within a year or two, since, apart from the financial question, such haste to build up to the full limit would tend to cancel the good impression created by Germany's attitude up to now. It is far more likely that her Government, having gained its point, will proceed methodically at a normal *tempo* with the restoration of the fleet. There is reason for believing that details of the German programme have already been communicated to the British Government; in fact, it is reliably stated that a periodical exchange of information regarding shipbuilding programmes is among the unwritten clauses of the agreement. Another point settled last week was the status of the so-called "pocket battleships." Although displacing only 10,000 tons, these remarkable vessels are to be classed as battleships. Four have been built or laid down up to the present, and a fifth "armoured ship" is on the stocks. This last unit, however, may prove to be of considerably greater tonnage. From the technical point of view the future German designs for various types of warship should be exceptionally interesting. Judging by past performance, the new products of German constructors and engineers may be expected to be anything but commonplace.

It is rather early to speculate on the effects which the agreement with Germany may have on our own naval policy. Long before there was any thought of such a compact, it was evident that the time was approaching when British naval requirements must be reviewed in the light of developments abroad. The Washington and London treaties both expire at the end of next year, their renewal having been placed out of question by the Japanese act of denunciation. While the termination of the Washington Treaty may be a matter for genuine regret, in that it has undoubtedly moderated naval competition and saved very large sums of money during the past fourteen years, no tears will be shed in this country over the demise of the London Treaty. The latter covenant, which might have been devised expressly as a means of aggrandising foreign navies at the expense of the British fleet, has certainly had this effect. Especially has it reduced our strength in cruiser and anti-submarine tonnage to a dangerously low ebb. In ships best fitted to protect our ocean trade we are, relatively, weaker than at any time within the last two centuries. Consequently, even if Germany had not put forward her naval claims, we should still have been compelled to embark on a large building programme in the early future. The German development may compel us to accelerate, and perhaps amplify, this programme. It may also bring about the re-establishment of one or more of the North Sea naval bases which were closed down after the war. Be that as it may, the lapse of the Washington-London treaties will restore to us a freedom of action of which, no doubt, reasonable advantage will be taken. Whether those treaties will be replaced by some more elastic formula of multilateral limitation, or by an interlocking series of formal or "gentlemen's" agreements among the Powers concerned to keep their programmes within certain limits, remains to be seen. In spite of the pious hope expressed in their Notes by the British and German Governments, that their joint compact will "facilitate the conclusion of a general agreement between all the

Naval Powers of the world," we see no immediate prospect of a new and comprehensive naval treaty likely to satisfy the claims of all the Powers concerned, ourselves included.

Gods and Brazen Images.

FROM the days of its fledging we have pictured Mr. Roosevelt's Blue Eagle as a tyro on a tight-rope. Month by month we have waited to see it fall from its unstable perch. Never did we suspect that it would be shot down by the power that had set it up, killed, as the saying is, by a feather from its own plumage. On May 27th it was, in the words of the *Iron Age*, "swept aside by the annihilating and unanimous decision of the Supreme Court. N.R.A. exists to-day only by sufferance of business and industry. For codes are nothing more than voluntary agencies. They are no longer law merchants of the land. They have no legal force back of them. The almost two years' experimentation in government regimentation has left only a shell and the Blue Eagle indeed has become a dodo." There is a touch of dramatic fitness in the fact that the Schecter poultry case was the immediate cause of the fatality. When the Supreme Court ruled, in that case, that Congress had exceeded its authority in delegating power to the President to proclaim codes and to fix wages the Blue Eagle came "to earth like a plummet, and with it its 557 codes."

Whatever may be the outcome of the efforts to revive the unhappy bird, it may be said definitely that the great and unbelievable experiment in the Land of Liberty has come to an end. "Adversity makes strange bed-fellows," but when the National Recovery Act was passed we marvelled that a people with a constitutional belief—not invariably exercised—in the rights of the individual had given autocratic powers to its President. America was carried away by the magnificent scheme of planned economy by which she expected to lift herself out of the industrial morass by her own boot-straps. The enthusiasm of the first few days did not last long. Difficulty after difficulty was encountered and when it became manifest that the great plan had liberated a host of labour troubles, from which the United States had been kept free under individualism, love of the Blue Eagle began to turn to fear, which is the father of hatred. Only in toil and tribulation, and not with a willing heart, were the five hundred and fifty-seven codes drafted and signed. We suspect, not without good evidence, that all this time industrial America was praying for someone to wring the Blue Eagle's neck, and that a sigh of relief went up to the high heavens when the Supreme Court did for industries what each of them feared, or knew not how, to do. Says Mr. Van Deventer, in one of his articles which sparkle in the pages of *Iron Age*, "The Supreme Court has spoken. By unanimous decision it has turned thumbs down on the brain trusters and constitution 'busters,' who for two years have been attempting to build a super-government in America, a consolidated clan of bureaucracies having the assumed power to make and enforce our laws. . . . Beyond the *requiescat in pace* which the decision pronounces over N.R.A., its broad and emphatic terms also sound the death knell for the Wagner labour disputes bill, the Black 30-hour week bill, and all of the other pending legislative measures which are so manifestly and unconstitutionally conceived in class interest. . . . The Schecter chicken has broken the American goose-step. . . . The gods and brazen images of a regimented economy and a philosophy of scarcity" have been smashed.

The Blue Eagle was the totem of a national industrial effort without precedent. It stood for a symbol that all the industries of the United States were submitting themselves to national control. It has fallen because once the original spiritual impetus—as George Meredith might have called it—had died down there remained nothing in true harmony with the American genius. The froth being off, it was found that the tankard was empty. In no country in the world, even Great Britain not excepted, has the rise and progress of industries owed so much to individualism, both of employers and employed. The Blue Eagle struck his talons into that individualism and aroused opposition. It is not that American industrialists are lacking in national spirit—far from it. But they believe that the best efforts for the welfare and benefit of all are made when everyone is left free to work out his own salvation. They have shown that State control of industry may be borne up to a point, but beyond that point it is odious and intolerable to them. Speaking at the May meeting of the American Iron and Steel Institute, that veteran steelmaster "Charlie" Schwab, said: "While we all admit that no great advances are ever made without the development of some features which need correction, the challenge to the young men of to-day is to avoid the heaping upon themselves of burdens and suppression of individual initiative that will prevent the same opportunities to acquire property, security, and some of the luxuries of life that have been the rewards of the past." Mr. Schwab was addressing himself particularly to the young men of America, but there is every reason why the youth of this country should listen to him. Here there is a growing belief that industrial organisation on a vast scale, probably by the State, could achieve what individual effort has, it is thought, failed to achieve. There are many who desire to sacrifice the flexibility and adaptability of the individualistic system for a rigid all-embracing "plan." In their desire for economical tidiness they fail to recognise that the muddling which they condemn promotes energy as the turbulence in a gas engine cylinder promotes combustion. The demise of the Blue Eagle is a warning to them, and a useful example for those who are convinced that as little restraint as possible should be put upon individual initiative.

Obituary.

HOWARD COPPUCK LEVIS.

WE deeply regret to have to announce the death of Mr. Howard Coppuck Levis, late chairman of Associated Electrical Industries, Ltd., and the British Thomson-Houston Company, Ltd. He died on June 19th at Villa Aturus, Chiberta, Biarritz, aged seventy-six years. Mr. Levis was associated with the British Thomson-Houston Company, Ltd., for over twenty-seven years. He came to England from the General Electric Company, of New York, in January, 1902, when he joined the board of directors of the British Thomson-Houston Company, Ltd., and in February, 1904, he was appointed managing director and subsequently became its chairman as well. On the formation of Associated Electrical Industries, Ltd., in December, 1928, he was appointed its first chairman. In June, 1929, he relinquished the position of director and chairman of the British Thomson-Houston Company, Ltd. He left England in August, 1929, and after some time spent in travel made his home at Biarritz.

PETER McMENEMEY.

MANY of our readers connected with shipbuilding and marine engineering will learn with deep regret of the death of Mr. Peter McMenemey, the manager of Cammell, Laird and Co.'s London office. Mr. McMenemey, who died at his home, 127, Victoria-street, Westminster, on Friday, June 21st, after a short illness, was only sixty-eight years of age. He was associated with his company for over fifty-three years, and, in addition to looking after the publicity work, had been private secretary to the chairmen of the company under three different regimes. He was born at Birkenhead, and was educated at Holt Hill School and the Liverpool Institute. When about fifteen years of age he entered the service of Laird Brothers, under the late Mr. Charles Kind, and he remained with the firm until May, 1906, when, on the amalgamation of Laird Brothers with Charles Cammell and Co., of Sheffield, under the title of Cammell, Laird and Co., he removed to London as private secretary to the chairman, Mr. J. M. Laird. Mr. McMenemey also held the same position when the late Dr. Elgar took over the chairmanship, and later with Mr. W. L. Hichens, the present chairman, whom he served for the past quarter of a century. He was subsequently appointed manager of the firm's London office. Mr. McMenemey was also a director of Michell Bearings, Ltd., of Benwell, Newcastle-upon-Tyne.

Literature.

SHORT NOTICES.

The Elements of Motor Vehicle Design. By C. T. B. Donkin, Assoc. M. Inst. C.E. Second edition. Oxford University Press. London: Humphrey Milford. Price 12s. 6d.—As the title of this book implies, the work is concerned almost solely with design, so that those who require to be told how a mechanism works must seek elsewhere. Necessarily, and especially in connection with changes that have come about since the first edition was published, a certain amount of descriptive matter has been included. But it has been reduced to the lowest possible limit. The book is in fact primarily intended for the use of designers, draughtsmen, and students, and it demands on the part of the reader an elementary knowledge of mechanics and practical mathematics. In general, the system chosen is that of first explaining the relation between theory and practice, and subsequently of deriving actual working formulæ. The range of parts covered is wide. After two preliminary chapters on the use and construction of motor vehicles and materials of construction respectively, the six following chapters deal with the engine, valves, and carburation and ignition are picked out for special treatment in separate chapters. Thereafter Chapters IX to XIII inclusive deal with the various mechanisms in the transmission, including the gear-box and the rear wheels. Two chapters are devoted to the problems involved in the design of steering mechanisms, and the final three divisions deal with brakes, frames and springs, and radiators and pumps respectively. A number of questions are set out at the end of each chapter, and the answers are to be found at the back of the book.

Crushers for Stone and Ore. By W. T. W. Miller. London: Mining Publications, Ltd., 724, Salisbury House, E.C.2. Price 15s. net.—This book is based upon a number of articles, in various mining and quarrying journals, which have been collated and extended by the author, who has had many years' experience with crushing plant. It opens with several chapters on jaw breakers, giving particulars of the various types of jaw suitable to different ores, toggles, bearings, lubrication, &c. Then follows a section devoted to gyratory crushers, concluding with a chapter discussing the relative merits of jaw and gyratory crushers. Roll, disc, and swing hammer breakers are then dealt with, followed by a discussion on the factors to be considered in selecting a crusher to meet a given set of conditions. The concluding item of the book is a chapter on screen analysis of crushed products, which contains many useful diagrams of actual tests, indicating the grading analysis of products obtained at varying settings of the machines. To be complete a book of this type has to give many descriptions of machines made by the various manufacturers, and the reader is, at first, apt to conclude that much material of a catalogue nature is included. Examination shows that these descriptions have been so collated and so much supplementary information is given that the book is thoroughly up to date, and will prove a useful addition to the existing literature on mining and quarrying.

Shellac. By E. J. Parry, B.Sc., F.I.C. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C.2. Price 12s. 6d. net.—This book deals with shellac from all its aspects—origin, production, manufacture, analysis, chemistry, and commerce—and, as the author has had thirty years of experience in the shellac industry, he is particularly well qualified to write upon the subject. We cannot do better than quote the remarks of Sir H. Lindsay in his "Foreword": "I commend this book most heartily to the business man, to the scientist, and to the student of economics. It shows a wonderful grasp of the many complex problems underlying the shellac industry and trade. . . . Particularly interesting are the chapters on analytical methods, on the chemistry of shellac, and on its commerce and uses. The suggestions Mr. Parry offers under these heads seem to me to be of special importance."

SIXTY YEARS AGO.

PLIMSOLL'S name is to-day so familiarly associated with the load line of ships that we are perhaps apt to forget that the legislative origin of the Plimsoll line dates from a Bill introduced into the House of Commons sixty years ago by him and a number of members who thought with him and that this Bill—the Merchant Shipping Amendment Bill—had no fewer than fifty-five clauses covering many subjects of marine interest besides the loading of ships. It is to that Bill, for instance, that we owe the origin of the Board of Trade's control over the mercantile marine. To it also we may date the present arrangement whereby at Courts of Inquiry the Judges are assisted by assessors possessing expert nautical knowledge. In our issue of June 25th, 1875, in a leading article we discussed the progress which the Bill was then making through Committee in the House of Commons. Clause by clause it met with much opposition. Clause 18 provided for the maintenance of a proper look-out. One member moved as an amendment to it that in the neighbourhood of rocks or shoals the lead should be kept constantly going. The amendment was defeated by a majority of a hundred. Yet quite recently the "Schiller" and the "Aberdour" had been lost through negligence in not heaving the lead and the "Cadiz" by incompetency on the part of the sailor entrusted with that duty. A great amount of discussion arose over one clause in which it was sought to prohibit the issue of advance notes to sailors in payment of the wages which they were still to earn. If the picture which we drew in our leading article is trustworthy we may well agree with the opinion that the advance note system was "most pernicious and one of the greatest obstacles to the amelioration of the condition of merchant seamen." The system was favoured by shipowners because it enabled them to obtain crews and by sailors because, so we find it alleged, it enabled them to get more money to spend on "riot and debauchery." The real gainers from the system were, we said, the crimps. When the sailor, returned from a voyage, had spent all his money he could readily obtain more from the crimp who charged a high rate of interest and relied for security on the advance note which the sailor would obtain from his next employer. The system had reached such a pitch that at Quebec the crimps had been known to come on board a ship with loaded revolvers, to order the captain to his cabin, to take the men off by force and to reship them in a drunken condition. Many a ship we said had as a direct consequence been lost while going down the St. Lawrence. The clause abolishing the advance note system was hotly debated. As a compromise between the opposed parties it was suggested by the President of the Board of Trade that the issue of advance notes should be limited to one month. This suggestion thoroughly displeased both sides. Ultimately it was decided that the subject was too important to be dealt with hastily and the clause was postponed.

The Tir John Power Station.

No. II.

(*Concluded from page 653, June 21st.*)

THE two 30,000-kW Parsons reaction turbo-generator sets shown in Fig. 11 operate at 600 lb. per square inch pressure and 825 deg. Fah. Each machine is composed of a two-cylinder tandem turbine driving a three-phase 33–36-kV alternator at 3000 r.p.m. The most economical load in each case is 24,000 kW. Expansion takes place in the H.P. cylinder from the stop valve pressure, down to 13 lb. absolute. The steam is then led by way of a pair of overhead pipes with expansion joints to the centre of the L.P. cylinder and passes in opposite directions to the ends, where it is exhausted into the condenser at a vacuum of 29in. With the exception of the last three rows all the blades in the H.P. cylinder are end tightened; the remaining blades in that cylinder and all those in the L.P. cylinder being of the radial clearance type. In the L.P. cylinder there are forty-eight pairs on each side of the steam inlet. To obtain the maximum load of 30,000 kW, the first nine pairs of fixed and moving blades are by-passed.

The steam chest is mounted on a separate bed plate and is connected to the H.P. cylinder by flexible U pipes. It contains, as usual, a separate emergency valve and two double-beat governor valves controlled by oil relays.

As the general construction of Parsons turbines of this type should be familiar to our readers, it will suffice to call attention to a few additional points. To ensure uniform cooling when shutting down and easy restarting, motor turning gear is mounted between the cheeks of the low-pressure exhaust cover of each set, and the drive is transmitted through a toothed wheel attached to the coupling. A high-pressure oil supply is also provided to facilitate starting and slow running.

Like all modern machines, the Swansea sets are designed for the progressive heating of the condensate by partially expanded steam tapped off the turbine at suitable temperatures. A diagrammatic arrangement of the feed-heating system is given in Fig. 12, whilst the table below gives the type of heater used for each of the four stages, steam pressures and temperatures, and inlet and outlet feed temperatures:

Stage.	Type of heater.	Steam press., lb./in.² abs.	Sat. steam temp., °Fah.	Feed heat temp.	
				Inlet.	Outlet
				Deg.	Deg.
1	Low-pressure surface type	6·85	176	80	160
2	Direct contact deaerator and evaporators	16·0	216·3	160	214
3	High-pressure surface type	61·5	294	214	284
4	High-pressure surface type	169	368	284	358

The totally enclosed 33–36-kV alternators are designed for 37500 kVA maximum continuous rating (0·8 power factor) at a speed of 3000 r.p.m. The kVA output, the makers claim, is large for the high speed of rotation, the peripheral speed being kept moderate by the adoption of a comparative long rotor, composed of a solid forging. As on all other Parsons 33–36-kV machines, the stator core conductors are of the Parsons triple concentric stranded cable type, with the individual wires insulated with asbestos and spiralled in a definite lay to eliminate eddy currents and insulated as a whole with micanite moulded round them during manufacture. To avoid eddy currents due to leakage flux, the stator end shields are composed of fibrous non-conducting and non-magnetic material. Direct-coupled exciters provide the alternator excitation, and self-excited auxiliary exciters energise the field of the main exciters.

The multiple inlet ventilating system, applicable to all machines irrespective of their length, is employed, and as the cool air is admitted along the entire length of the stator, uniform ventilation and effective cooling of the stator core, end windings, and rotor are secured. Air for each alternator is circulated by means of two motor-driven fans mounted inside the foundation block, an arrangement which saves a large amount of space. If one of the fans should be put out of service, the other is capable of supplying sufficient air to enable the alternator to develop 80 per cent. of its rated output. At times of light loads one fan will, of course, suffice, and the alternator works at the highest possible efficiency. Two coolers arranged in two sections serve for cooling the heated air, and as one section will serve for 80 per cent. full load, one cooler can be cleaned while the set is in operation. Together with the two fans, the coolers are accommodated inside the foundation block, and they can easily be withdrawn for inspection.

In accordance with the makers' latest practice, the slip rings, exciters, and ventilating fans are totally enclosed and are ventilated by means of cool air drawn from the main air circuit. In the event of failure of the air cooler water supply, emergency air inlet and outlet doors enable the alternators to operate on an open air circuit.

FIG. 11—30,000-KW TURBO-GENERATOR SETS

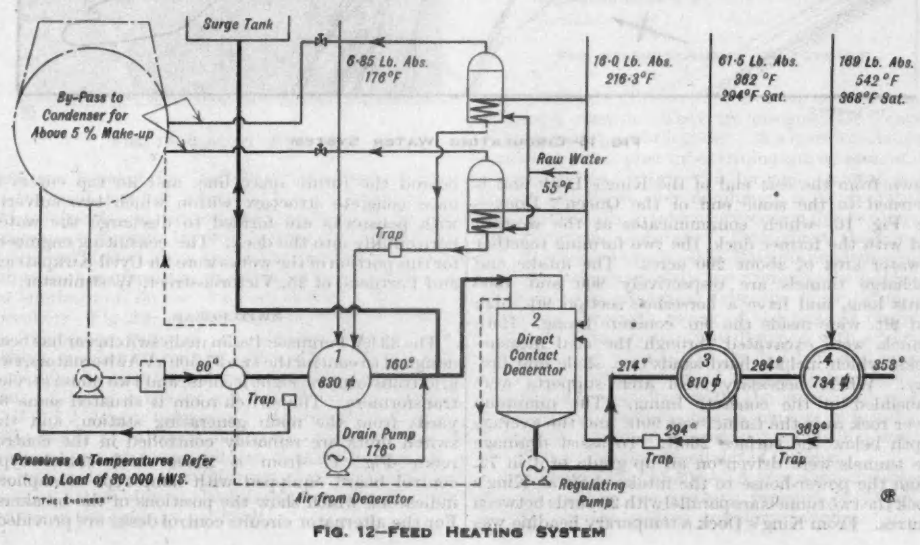


FIG. 12—FEED HEATING SYSTEM

CONDENSERS AND PUMPS.

The two condensers for the 30,000-kW generating sets were manufactured and installed by Vickers-

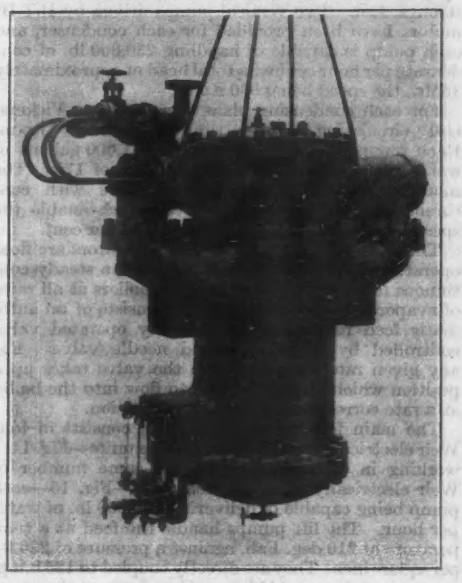


FIG. 13—AIR EJECTOR

Armstrongs, Ltd., of Barrow-in-Furness, who were also responsible for the circulating water system and the circulating water pumps, which are of the Vickers-Gill propeller type. The welded shells with twin exhaust openings to suit the Parsons turbines were

delivered in two sections, and a relatively small amount of welding had to be carried out on site. One half of each condenser can be cleaned, while the other half remains in service, each section having its own Vickers-Gill circulating water pump. The circulating water is discharged from the water boxes through separate discharge pipes which join a common bus-main running to the outlet channel of the circulating water culvert. On each circulating water pump suction there is one 26in. electrically operated penstock and one 26in. electrically operated sluice valve. Tappings on the inlet pipes supply water to the air and oil coolers. When operating with circulating water at a temperature of 55 deg. Fah. at the inlet each condenser is guaranteed to give a vacuum of 29in. with the barometer at 30in. The total tube surface of each condenser is 30,000 square feet. The tubes, which were supplied by John Booth and Co., of Birmingham, are composed of aluminium-bronze, which was selected as the most promising after exhaustive tests with all types of tube material in the circulating water to be used. Duplicate three-stage Weir "Maxivac" air ejectors (Fig. 13) with surface inter and after cooling for condensing are provided for each set. The primary ejector operates with steam at 400 lb. per square inch and 825 deg. Fah., and is capable of handling 75 lb. of dry air per hour. The coolers are of a design suitable for use in feed systems in which the pressure of the condensate exceeds 25 lb. to 30 lb. per square inch, the condensate passing through the tubes of the inter-coolers so that the tubes and headers alone are subject to the condensate pump discharge pressure. The steam nozzles are of monel metal and the diffuser nozzles of gun-metal. A water level gauge is fitted to each ejector stage, as shown in Fig. 13.

Besides the main air ejectors there are six sets of Weir steam jet air exhausters. Two are for rapidly raising the vacuum in the condenser and four for creating the necessary vacuum for priming the main circulating water system to enable it to be filled within a few minutes before starting the circulating pumps. Each of these exhausters consists of a single jet air ejector with a monel metal nozzle and gun-metal diffuser.

The condensate extraction pumps were supplied by Drysdale and Co. to the order of Vickers-Armstrongs, Ltd. Two vertical pumps driven by B.T.H. motors have been provided for each condenser, and each pump is capable of handling 230,000 lb. of condensate per hour against a total head of approximately 155ft., the speed being 960 r.p.m.

For each condensing plant there are two Vickers-Gill circulating pumps running at 720 r.p.m. Each pump is capable of handling 11,000 gallons of water per minute against a total head of 17ft. The motors are B.T.H. slip-ring machines with continuously rated rotor resistances, which enable the speed to be reduced to the extent of 40 per cent.

The Weir "Robot" boiler feed regulators are float operated and are designed to maintain a steady continuous flow of feed water into the boilers at all rates of evaporation. Each regulator consists of an automatic feed regulating hydraulically operated valve controlled by a float-operated needle valve. For any given rate of evaporation the valve takes up a position which allows the feed to flow into the boiler at a rate corresponding to the evaporation.

The main feed pump installation consists of four Weir electrically driven lift or booster units—Fig. 14—working in conjunction with the same number of Weir electrically operated feed units—Fig. 15—each pump being capable of delivering 300,000 lb. of water per hour. The lift pumps handle the feed at a temperature of 216 deg. Fah. against a pressure of 230 lb. per square inch. They are directly coupled to 125 b.h.p. motors running at 1450 r.p.m., and are of the usual Weir electro-feeder design with a hydraulic balancing device. The main feed pumps handle the feed at a maximum temperature of 358 deg. Fah. The suction pressure is 215 lb. per square inch absolute, and the discharge pressure 800 lb. per square inch absolute. They are driven through variable-speed Vulcan-Sinclair couplings by electric motors developing 340 b.h.p. at 1450 r.p.m. By means of the Vulcan-Sinclair couplings the pump speed is controlled to maintain the required pressure difference across the boiler feed regulators. The pumps are of the barrel casing type. All the feed pump motors were supplied by Laurence, Scott and Electromotors, Ltd., of Norwich, who also built the "Emcol" motors for the Hardinge pulverising mills and those for the induced draught primary air and secondary air fans. A special feature of the feed pump motors is that they are fitted with a separate motor-driven fan for passing the cooling air over the "Emcol" tubes to obtain silent running. Another feature of the pump motors is that they are provided with forced lubrication.

A Weir standby steam turbine-driven feed pump is capable of delivering 600,000 lb. of feed water per hour at a temperature of 160 deg. Fah. from a suction pressure of 25 lb. per square inch absolute against a discharge pressure of 800 lb. per square inch absolute. This is also a barrel casing pump and is fitted with the usual Weir pressure regulating governor, in addition to an automatic "cut-in" device which starts the pump in the event of the feed line pressure falling in consequence of the electrical pumps failing.

Vickers-Armstrongs manufactured and supplied to the order of C. A. Parsons and Co., Ltd., the evaporators for providing distilled make-up feed water. They are vertical coil units similar to many other evaporators supplied to power stations in this country and abroad. Two evaporators working in double effet are provided for each generating set, the primary effet taking steam from a low-pressure point on the turbine.

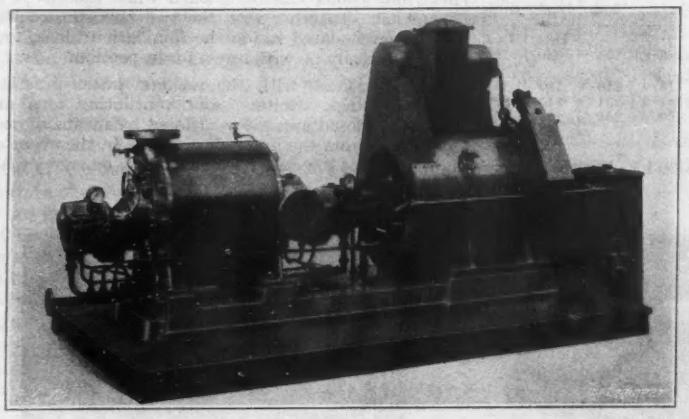


FIG. 14—LIFT PUMP

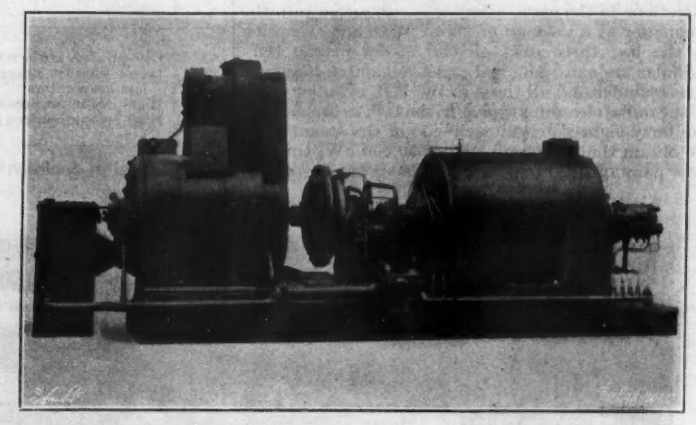


FIG. 15—FEED PUMP

CIRCULATING WATER SYSTEM.

Circulating water is obtained from the Great Western Railway Company's dock system. It is drawn from the east end of the King's Dock and is returned to the same end of the Queen's Dock—see Fig. 16—which communicates at the western end with the former dock, the two forming together a water area of about 200 acres. The intake and discharge tunnels are respectively 900 and 1300 yards long, and have a horseshoe section 9ft. high and 9ft. wide inside the 9in. concrete lining. Both tunnels were excavated through the coal measure rocks, which include hard sandstone, shale and fire-clay. Where necessary steel arch supports were embedded in the concrete lining. The minimum cover rock over the tunnel was 90ft. and the average depth below the surface 260ft. To assist drainage the tunnels were driven on an up grade of 1 in 72. From the power-house to the intake shaft at King's Dock the two tunnels are parallel with 20 yards between centres. From King's Dock a temporary heading was driven parallel from the discharge tunnel, and this arrangement with interconnecting temporary adits facilitated ventilation and haulage.

The four shafts are all 14ft. in internal diameter, the two at the power-house being about 300ft. deep, sunk through sandstone and lined with concrete with a minimum thickness of 15in. At the top they are enlarged to accommodate penstocks and are joined by 12ft. horseshoe tunnels 30ft. below the ground to two reinforced concrete water channels, each about 10ft. wide and 40ft. deep, running the full length of the pump-house. The intake channel is divided by a reinforced concrete wall from the pump-house and the pump suctions pass through this wall. The returning circulating water enters the discharge channel at a higher level.

An interesting feature of the work was the construction of the shafts at the dock ends of the tunnels. At King's Dock, 133ft. of water bearing alluvium, sand, and gravel overlies the rock, and at Queen's Dock 120ft. The shafts through this material and 20ft. into the rock were sunk by the freezing process and lined with cast iron tubbing backed and lined internally with concrete, the shafts being continued through the rock by ordinary methods. At King's Dock the intake shaft is located with its centre 80ft. behind the quay line. The water is conveyed through two screened openings cut into the dock wall and passes through a reinforced concrete culvert, carried on timber piles to an opening in the shaft. Penstock and bar screens are provided in a chamber formed in the culvert which has flexible joints at each end to prevent the weight being carried by the dock wall or the shaft.

At Queen's Dock there are no dock walls, but one is to be provided 160ft. in advance of the present shore line. The centre of the discharge shaft is 23ft.

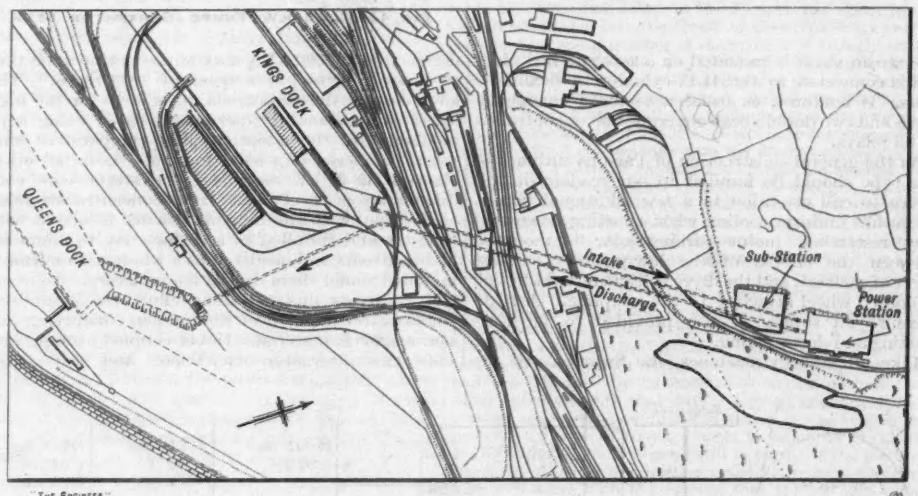


FIG. 16—CIRCULATING WATER SYSTEM

behind the future quay line, and its top enters a mass concrete structure within which two culverts with penstocks are formed to discharge the water horizontally into the dock. The consulting engineers for this portion of the works were Sir Cyril Kirkpatrick and Partners, of 25, Victoria-street, Westminster.

SWITCHGEAR.

The 33 kV Ferguson Pailin main switchgear has been designed to control the two 37,500 kVA alternators, two grid transformers, eight feeders, and two house service transformers. The switch-room is situated some 60 yards from the main generating station, and the switch units are remotely controlled in the control room—Fig. 17—from a sheet steel cubicle-type control board equipped with lamp-type semaphore indicators, which show the positions of the breakers. For the alternator circuits control desks are provided.

Besides manufacturing and installing the main switchgear, Ferguson Pailin were responsible for running the multi-core control cables and the installation of accessory equipment, such as engine-room telegraphs, loud-speaking telephones, automatic house telephones, &c. Liquid outdoor resistances serve for earthing the neutral of each alternator. The earthing circuits are controlled by electrically operated, metal-clad, oil circuit breakers, and means are provided for by-passing the resistance when desired. Normally, only one alternator star point is earthed. The alternator circuits are protected by circulating current Merz-Price transformers and relays. Time-delay earth-leakage relays serve for bus-bar protection. The grid transformers are protected by time-delay leakage relays, together with restricted earth-leakage equipment on the 33 kV windings. Four of the outgoing feeders are equipped with balanced-current directional parallel feeder protective relays, the remaining feeders having overload and earth-leakage protection.

The main metal-clad oil-filled switchgear represents the makers' latest practice. By arranging the two sets of bus-bars on either side of the switchroom in the well-known manner—Fig. 18—a central passage has been left for the removal of the oil circuit breakers. Each of the alternator and house service equipments has two circuit breakers to permit a change over from one set of bars to the other without breaking the circuit ; but each feeder equipment has but one breaker for "off load" bus-bar selection.

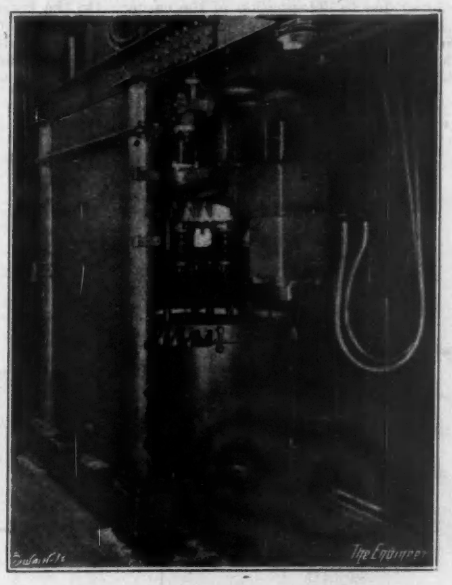


FIG. 19—CIRCUIT BREAKER

On load bus-bar selection can be arranged for. A transportation device and turntable permitting movement through 180 deg. enables a circuit breaker to be transferred along the centre through the switch units from one position on one set of bars to a position in another unit on the other set of bars. The circuit breakers—Fig. 19—are arranged for vertical isolation or complete removal by motor-operated screw lifting mechanism, which also serves for speedily removing breaker tanks for the inspection of contacts, &c. All the breakers are known as the makers' "R P 4 2" type, belonging to the round-tank range. The factor of safety is increased by the action of the cross-jet explosion pot, which is claimed to result in extremely low values of internal pressure since the seat of action during the interruption of a short circuit is in the cross-jet pot itself.

The breakers are completely fabricated and the machined joint between the tank and top plate is maintained tight by a large number of heavy section, short tank bolts, giving maximum elongation under internal stress. The internal operating mechanism is balanced, and there is no piston effect tending to reclose the breaker on short circuit. Throughout the entire length of the switchboards the bus-bars are widely separated. The current transformer chambers and cable sealing boxes are arranged at the back of the units. Potential transformers with fuses and resistances are contained in draw-out chambers readily accessible from the platform.

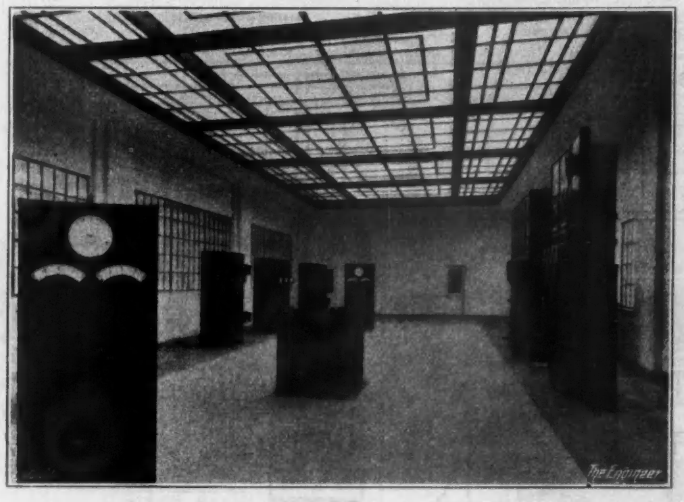


FIG. 17—CONTROL ROOM

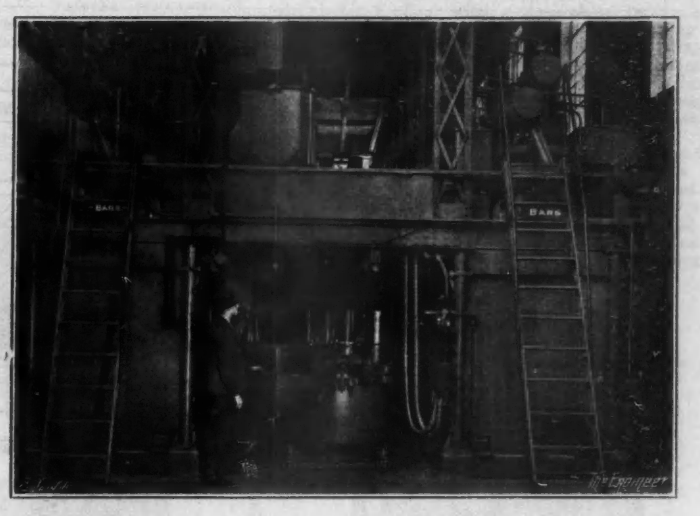


FIG. 18—MAIN SWITCHGEAR

All bus-bar, instrument transformer, and connection chambers are oil filled, the oil-filled portion of each unit consisting of two separate systems, each including one set of three-phase bus-bars and an oil conservator. Each system has an oil feed from the conservator to the chambers, and the bus-bar on each phase, individual pipes being run from each bus-bar and chamber to a common header, from which a single pipe is taken to the conservator vessel.

The oil system (Fig. 20) of each unit is separate from those of adjacent units. At the lowest point each oil system has an arrangement of valves which either permits the whole of the oil to be drained from the system or from any particular phase. Connection can also be made to an oil cleaning and drying plant, the cleaned oil being returned to the conservator vessel, from which the various bus-bars and oil-filled chambers are fed, whilst dirty oil is drained off at the bottom of the oil system. All oil-filled chambers are composed of fabricated sheet steel hydraulically

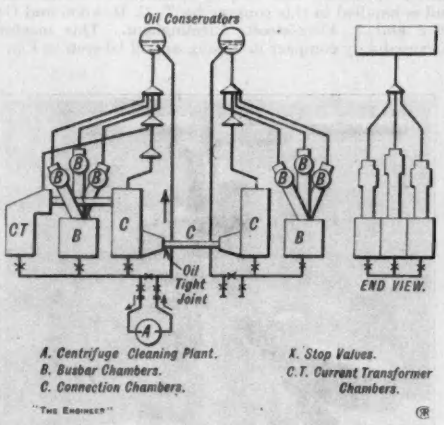


FIG. 20—SWITCHGEAR OIL SYSTEM

tested for oil-tightness and treated with a coating of special varnish. They are designed for complete phase separation throughout. A separator chamber, consisting of a copper tube terminating on each unit in a junction-box, is provided for each bus-bar, and a special metallic flexible diaphragm is incorporated in the junction-box to take up expansion due to temperature rise in the chambers. Throughout their length the bus-bars are insulated by Bakelite condenser bushings, which have an earth layer running the full length of the outside supporting tube, the layer being connected to the earth casing of the bus-bar chamber.

The oil filling system was designed with a view to affording easy assembly of the bus-bars and connections. The sub-division of the oil system into two sections corresponding with the main and reserve bus-bars and also into phases renders it possible to extend the board or to work on one bus-bar without interfering with the remainder of the gear.

The Hackbridge 12,500-kVA transformer shown in Fig. 21 reduces the working pressure of 33 kV to 6·6 kV for the station auxiliary supplies. It is a naturally cooled unit with a separate oil cooler, to be seen on the left. On load tap-changing gear, remote controlled by push buttons, gives a voltage variation of plus and minus 10 per cent. in 1·43 per cent. steps. The secondary side of the transformer, which is to be duplicated, is connected in series with reactance to 6600-volt bus-bars, which feed a number of 6600/400-volt Metrovick air blast transformers for station auxiliary supplies. At present the station is devoid of a house service set, but a 750-kW oil engine set is to be installed, and if it is necessary to employ it for starting some of the auxiliaries in the event of a complete shut down and no supply being available from the grid, it will be connected to the 6600-volt bus-bars. Two batteries are provided, one for emergency lighting and for operating circuit breakers, and the other for indicating lamps and the switchgear tripping circuits.

We give below a list of the main contractors, supplied by the consulting engineers, Messrs. Preece, Cardew and Rider, to whom we are indebted for assistance in the preparation of these articles.

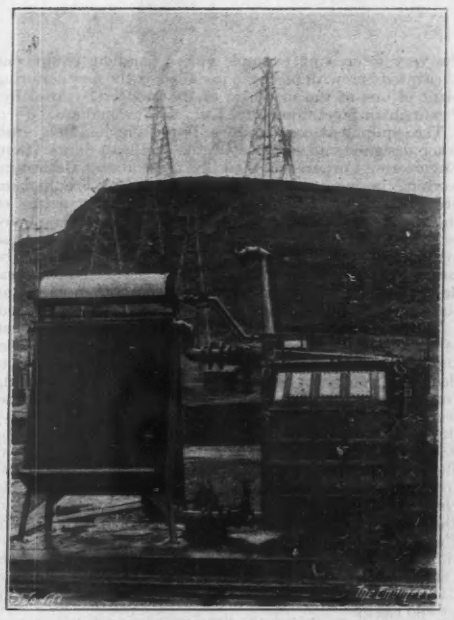


FIG. 21—AUXILIARY TRANSFORMER

Generating plant ..	C. A. Parsons and Co., Ltd.
Condensing plant ..	Vickers-Armstrongs, Ltd.
Steam-raising plant	International Combustion, Ltd.
Switchgear house ..	Griffiths Davies and Co.
Structural steelwork	Braithwaite and Co., Ltd.
Cranes	Sir William Arrol and Co., Ltd., and Cowans, Sheldon and Co., Ltd.
Coal handling plant	New Conveyor Company, Ltd.
Main buildings ..	E. Turner and Sons
Ash handling and gas washing plant ..	Jas. Howden and Co. (Land), Ltd.
Pipework	Aiton and Co., Ltd.
Feed pumps	G. and J. Weir, Ltd.
Switchgear	Ferguson Pailin, Ltd., and British Thomson-Houston Company, Ltd.
Air compressors ..	Browett, Lindley (1931), Ltd.
Transformers ..	Hackbridge Electric Construction Company, and Metropolitan-Vickers Electrical Company, Ltd.
Cables	Callender's Cable and Construction Company, Ltd.
Batteries and motor generators	British Thomson-Houston Company, Ltd.
Shunting locomotive	Hunslet Engine Company
Boiler control equipment	Allen West and Co., Ltd.

16-Ton Ore Handling Grab Crane.

PRESENT-DAY practice in steel production necessitates the employment of mechanical equipment of a highly perfected type for the handling of the various classes of raw material used with the maximum of despatch and minimum of cost. Such equipment must necessarily be of robust design to ensure continuous service under very arduous conditions. The United Steel Companies, Ltd., of Sheffield, have had these desiderata continually in view in the programme for the modernisation of the works under their control, and it is due to their initiative that the very interesting example of ore handling equipment illustrated herewith has been installed at the new sintering plant of one of the members of the group, the Appleby-Frodingham Steel Company, Ltd., at Frodingham.

The equipment consists of a 16-ton ore handling grab crane designed and supplied by the Wellman Smith Owen Engineering Corporation, Ltd., of London and Darlaston, working in conjunction with the Appleby-Frodingham Steel Company, Ltd., which built the girder structure of the crane. All girders and framework upon the crane are built up with welded instead of riveted joints. The success attending the use of this method of construction must be largely attributed to the facilities available in the structural department of the Appleby-Frodingham Company and the excellence of the material and workmanship employed.

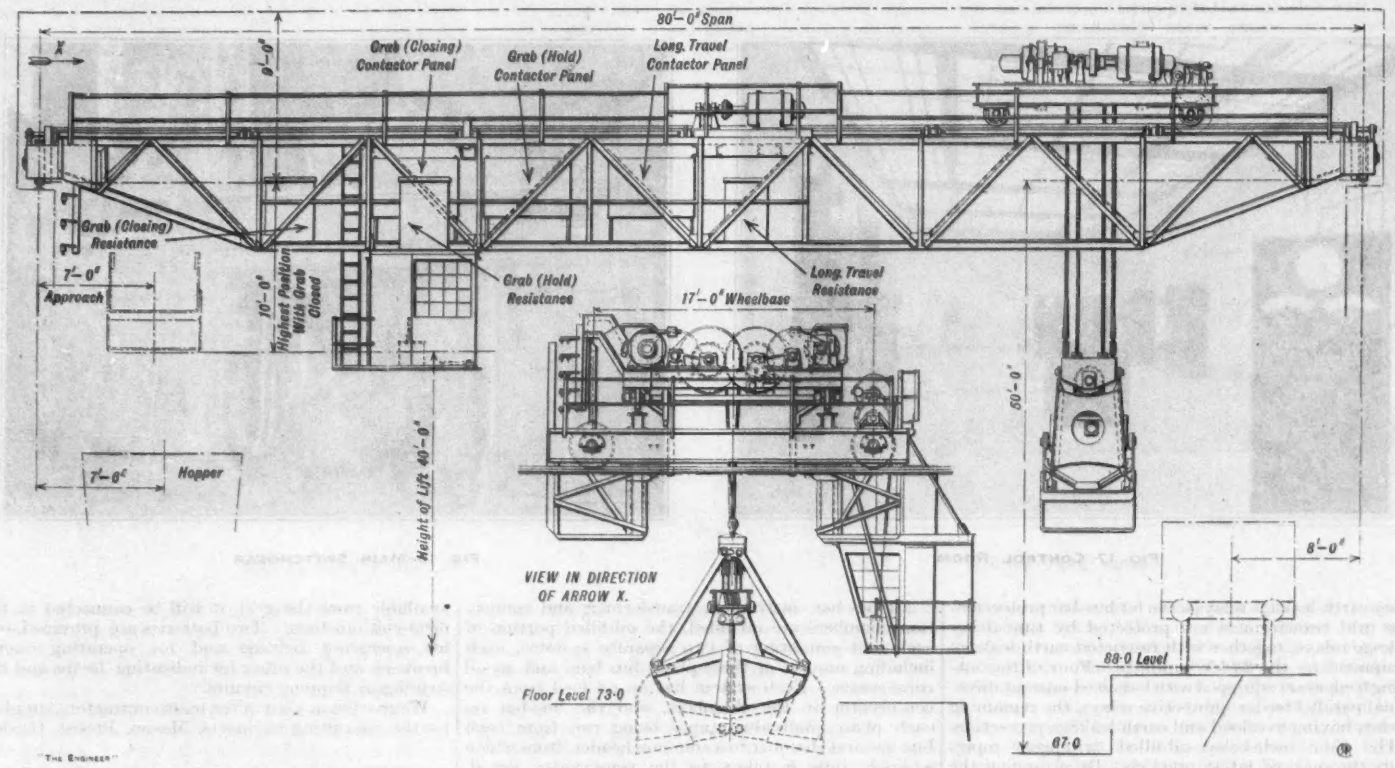
The crane operates in a roofed building having a span of 80ft. between the centres of the rails, and a height from the ground level to the gantry rail of 50ft. It is required to deal with iron ore of 4in. size and under, varying in weight from 80 lb. to 210 lb. per cubic foot, the ore being at times wet and sticky. The load is lifted by means of a heavy duty "Priestman" four-rope grab of all-steel construction, with a flush capacity of 100 cubic feet and the speeds of the crane permit 100 tons of ore per hour to be transferred from stock to hopper when handling 5-ton grab loads: that is to say, with a lighter type of ore. The speeds of the various motions together with the motors operating them, are as follows:—Hoisting, 16 tons at 85ft. per minute, two motors, each 60 b.h.p. at 480 r.p.m.; cross traverse, 16 tons at 120ft. per minute, 15 b.h.p. at 715 r.p.m.; travel, 16 tons at 350ft. per minute, 60 b.h.p. at 480 r.p.m.

The grab hoisting mechanism consists of two barrels, each driven from a separate motor through hardened steel gearing, the arrangement of the control equipment being such that the motors may be operated independently or in unison. When opening the grab the closing barrel only revolves, the weight of the grab being transferred to the hold barrel as the closing ropes are paid out. When hoisting the load the motors act together. The grab may be opened or closed in any position. The double motor hoist facilitates the rapid operation of the grab and dispenses with the use of clutches, &c. Two sizes of motors only are used on the crane, thus reducing the number of spares to be carried.

The cross traverse and longitudinal travel runners are steel tired on steel centres. Each motion is fitted with an efficient brake, solenoid operated, except in the case of the longitudinal travel, which is operated by a foot pedal. The teeth of all gearing have been designed to comply with the requirements of B.S.S. No. 436 and are hardened by the "Shorter" process. The bearings are automatically lubricated by "Helios" grease pumps driven from the various motions, thus providing a regular supply of lubricant during the operation of the crane and avoiding wastage when it is idle.

Contactor type control equipment is provided for each 60 h.p. motor and a drum controller for the 15 h.p. motor. The grab closing and holding motors are controlled by two master controllers fitted with a single vertical operating lever giving "joy-stick" control, limited by a gate plate. The scheme of control is such that the grab having been closed by the closing motor, current relays permit the starting up of the hold motor, and further predetermined movements of the operating lever ensure that both motors exert the same effort in raising the closed grab. The operator's cabin situated towards the centre of the span permits a full field of view to be obtained. Auxiliary control equipment is housed in this cabin and the main contactor panels, &c., are situated in the main structure, to which easy access is provided. Rigid conductors are employed for conveying current both to the crane and across the crane girders.

The crane girders were submitted to a workshop load test by placing a roll weighing 35 tons on one end and rolling it towards the centre, a deflection of $\frac{1}{4}$in. being shown on both sides. After complete erection at site the crane was tested with a 25 per cent. overload, the deflection readings being similar to those observed during the shop test.



16-TON ORE HANDLING GRAB CRANE

The Amsler Testing Machine.

AN interesting testing machine has been produced by Alfred J. Amsler and Co., of Schaffhouse, Switzerland, and is handled in this country by T. C. Howden and Co., of 5 and 7, Fleet-street, Birmingham. This machine is exceedingly compact in design, as will be seen in Fig. 1, and has adaptations which enable it to be used for a variety of tests. Its principal function is to perform the "cupping" test, which is rapidly increasing in general use. For this test the machine is set up as in Fig. 2. As the whole machine takes the form of a cylinder it has only to be bolted down to a strong table or bench to be ready for use. At the bottom of this cylinder is a hand-operated, double-acting, screw type oil pump, which draws oil from the reservoir to be seen with its filter to the left in Fig. 2, and pumps it into the cylinder of the ram, which carries the cupping tool on its upper end. Various tools can be used; the cupping tool rests on a spherically seated rod on the piston head. The pressure applied can be read on the gauge, visible in Fig. 1, while the length of travel of the ball, and therefore the depth of cup, is read off a vernier index on the side of the cylinder, visible in Fig. 1. The final loading is recorded on a dummy pointer on the pressure gauge. The test piece is passed through a slot in the machine just above the ball. It is held in position by two clamping rings as shown in Fig. 2. The lower one rests on a centring disc and the upper one is fixed to the clamping screw by a bayonet catch and serves as a die. Both are replaceable and different sizes can be used. The clamping screw which forms the top of the machine can be tightened or left slack to enable the metal to "run" under test. It carries a scale which gives the thickness of the test piece to $\frac{1}{50}$ mm. around its edge, while an index aperture pointer gives a first reading to the nearest millimetre. The test piece can be watched during test through the top of the clamping screw, and its behaviour noted. This machine can also be used for Brinell tests when combined with the Amsler ball imprint depth indicator. This consists of a dial indicator reading to $\frac{1}{100}$ mm., spring mounted in a casing, which screws into the Amsler testing machine instead of the clamping screw. At the lower end three small legs project and enable the indicator to rest on the test piece, and so overcome any inaccuracies of reading due to deformation of the casing. On the lower end of the indicator is the Brinell ball, which is mounted on the recording plunger of the indicator. An accurate Brinell reading is thus assured. Finally, an arrangement shown on the right of Fig. 2 enables a tensile test to be made. A 4in. test piece is used and the whole arrangement consists of a single piece of supplementary apparatus which screws into the clamping screw hole. It consists of a lower clamp which is rigid with the body of the machine, having two rods passing through it. These rods support the upper clamp at their upper ends, and are held in a circular plate which itself rests on the top of the piston. The pressure applied to the piston thus becomes tension applied to the test piece. The machines will handle up to 5 tons load, or 10 tons load, while special machines are available to take loads up to 30 tons. Various types of cupping tools and Brinell balls are available, so that tests to all standard specifications can be carried out.

FIG. 1—AMSLER TESTING MACHINE

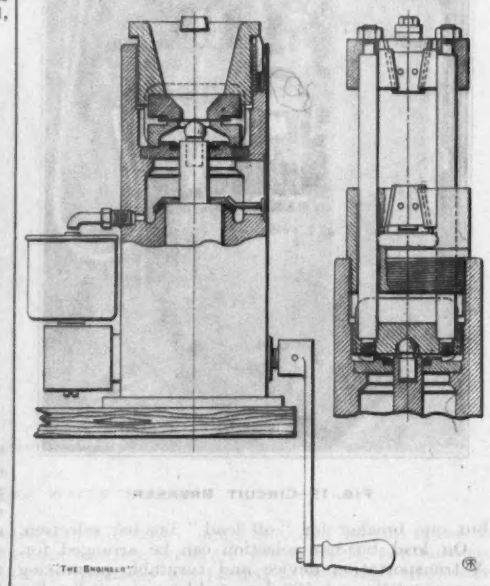
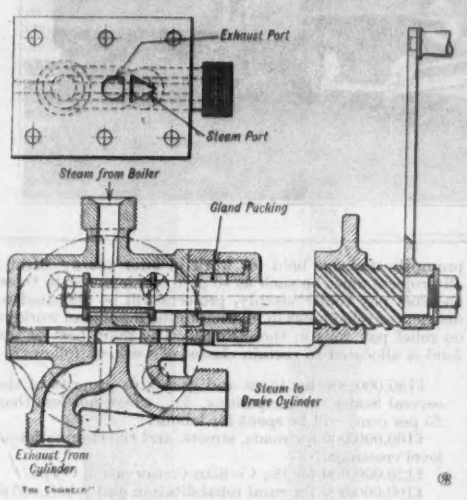


FIG. 2—MACHINE ARRANGED FOR CUPPING AND TENSILE TESTS

A Steam Brake Valve.

THE accompanying drawing, which is largely self-explanatory, illustrates the construction of the L & B steam brake valve invented by Mr. G. H. Brook, and made by the Hunslet Engineering Company, Ltd. As will be seen from the drawing, the device consists of a slide valve working in a casing over two ports. One of these ports admits steam to the brake gear, while the other is open to exhaust. As will be seen from the drawing, the steam admission port is triangular in shape, so arranged that as the valve is opened to "steam" the point of the triangle is first uncovered. Thus, as the valve is opened



STEAM BRAKE VALVE

slowly, there is at first a very limited area for the admission of steam, with the result that the brake is applied gradually and progressively, while, should the maximum brake force be required at once, the slide can be moved right across, exposing the full area of the port. As shown in the drawing, the valve is operated through a spindle by a handle, the rotary motion of which is converted into an axial movement by a quadruple wide-pitch screw. The latter is so designed that a movement of about 90 deg. serves fully to open the valve; and so that the handle can be moved to any desired position and left there. An alternative arrangement is to operate the valve by means of a rack type quadrant.

A Fusion Welded Crane.

AN interesting development of the steam travelling crane has recently been produced by Joseph Booth and Bros., Ltd., of Union Crane Works, Rodley, Leeds, in which fusion welding has been used very largely in the construction. Fig. 1 shows the crane, which was built to have a capacity of 2 tons at 20ft. radius, and, as it was intended for grabbing duty, very severe strains were to be expected on all parts from shock. In addition, the crane had to be built at a strictly competitive price against other cranes built on more conservative lines. The possibility of using a welded design did not at first seem feasible for reasons of cost, especially as patterns were already available for castings and a number of cranes were required. Any advantage in the saving of weight which might tell in favour of welding was neutralised by the fact that the weight of a travelling jib crane is necessary for stability, so that ballasting would have to be resorted to in any case. The reason for the use of welding in this instance was on the score of strength. It was felt that cast iron would not be substantial enough for the particular work involved, and that cast steel was too costly to be competitive. The scope of modern machine tools was taken into consideration in the design of the crane, and as a result the entire superstructure frame was welded into one piece, as shown in Fig. 2. It will be seen that a very substantial job has been made, but that accessibility has been carefully studied, so that no part of the mechanism is in any way difficult of access. Particulars of the crane are :—

Hoisting speed with 2 tons	140ft. per minute
Slewing speed with 2 tons	4 r.p.m.
Travelling speed	300ft. per minute
Engine : two-cylinder simple vertical, 7in. bore, 10in. stroke, slide valves, Stephenson's link motion	
Boiler :	
Vertical cross tube type	3ft. 6in. by 7ft.
Working pressure	100 lb. per sq. in.
Metre gauge	

The truck, as can be seen in Fig. 1, is a particularly clean design, thanks to the elimination of small parts owing to welding extensively. Numerous gussets and stiffeners being in one piece with the larger parts have reduced the number of bolts and nuts and improved the appearance of the job. Throughout the crane machine-cut steel gears have been used. The pillar with its rollers and paths is of particular interest. The weak point formed at the junction of the forged steel pillar and the crane carriage has been eliminated, as the pillar is built up solid with its base. Advantage was taken of this design to make use of two vertical roller paths instead of the more usual system of a bottom horizontal path and a top vertical path. By this means the difficulty of calculating the proportionate division of load between the pillar and the roller path was removed and a neater job was made of the connection. The costs of the finished crane showed that the extra cost of welding was balanced by the saving in material, while the machining costs were considerably reduced.

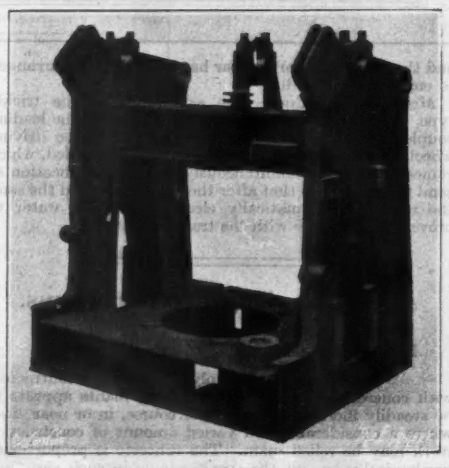


FIG. 2—WELDED SUPERSTRUCTURE

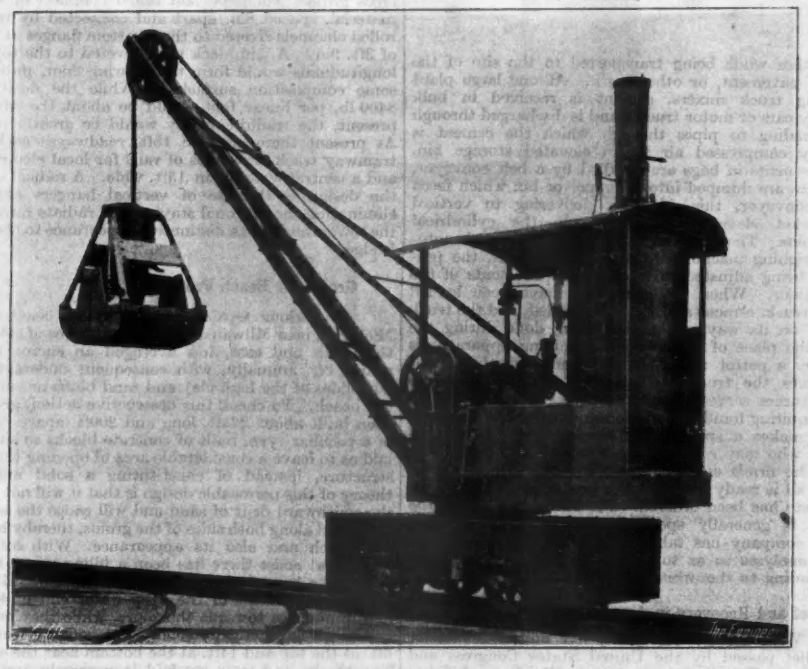


FIG. 1—TRAVELLING CRANE

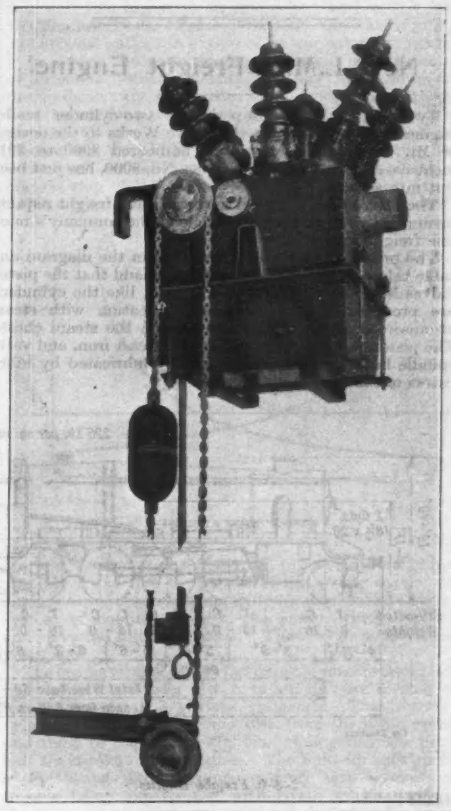
IN succession to Major L. F. Richard, who has just retired, Air Commander E. D. M. Robertson has been appointed chief aerodrome officer at Croydon.

A Reclosing Circuit Breaker.

A NEW oil-immersed self-reclosing circuit breaker has been brought to our notice by Switchgear and Equipment, Ltd., of Banbury, Oxon. Like other breakers of the kind it has been designed to reclose a circuit on which a fault has occurred after a short interval of time, and is applicable to 11,000-volt rural distribution networks. It can be mounted outdoors on wooden poles or similar structures or in sub-stations or kiosks in which sufficient headroom is available to allow for the fall of the operating weight, which requires an 18in. travel for each reclosing operation.

The unit, shown in the accompanying illustration, comprises an 11,000-volt, 100-ampère, triple-pole oil-immersed, outdoor circuit breaker, with a three-phase rupturing capacity of 50,000 kVA, when fitted with 15-ampère overload coils and 75,000 kVA when provided with 100-ampère coils. The operating handle usually supplied is replaced by a gravity-controlled automatic device for reclosing the breaker a predetermined number of times, and the interval between successive operations is adjustable between 10 and 48 seconds.

Provision is made for tripping the breaker by hand and for locking it in the open position. An "on," "off" indicator, easily visible from the ground, is also fitted. All the switch mechanism, including the overload trips and the escapement controlled timing device, is oil-immersed in a substantial heavy gauge welded sheet steel tank, secured to an upper chamber carrying the incoming and outgoing terminal arrangements and the fixing supports. All parts of the breaker subject to electrical potential are either in compound or in oil. When the tank is in position the contacts of the isolators are submerged in oil, the round copper connections leading therefrom through the bushing insulators or to cable sealing boxes being in compound. By means of a simple arrangement, the tank can easily be lowered to enable the switch contacts to be inspected. Alternatively, the whole of the switch mechanism can be lowered together with the tank, leaving the top chamber with the incoming and outgoing connections intact. This feature permits periodical replacement by a spare unit of the switch mechanism complete in its tank, thus facilitating inspection and overhaul without disturbing the connections.



RECLOSING CIRCUIT BREAKER

The top chamber is designed to accommodate various terminal arrangements, such as bushings for bare connections, cable sealing boxes, or any combination of different types of terminals. When required, live line connectors can be supplied to enable the circuit breaker to be entirely disconnected from the line.

The operating mechanism comprises a spring-loaded weight attached to a galvanised endless chain, which passes over two sheaves, one driving the operating shaft and the other running idle. For one reclose operation the weight has to travel 18in., and any number of operations can be arranged at one setting, depending on the total travel available. A single notch free-wheel device incorporated in the driving sheath ensures that each time it is reset by hand the weight must be moved into a position that results in the complete closing of the switch. An automatic clutch engages the falling weight with the retarding mechanism during the resetting of the links and catches and to declutch the retarding mechanism at the correct moment, thus ensuring quick and complete closing of the switch contacts.

The retarding mechanism comprises a train of machine-cut gun-metal gear wheels in permanent engagement with steel pinions driving an escapement, a system which has been adopted in preference to dashpots, to ensure more consistent and reliable timing under varying conditions.

The escapement also provides a simple means of adjusting the interval of time between successive operations. The switch mechanism conforms with the best circuit breaker practice. Components are securely clamped to tubular insulating supports with clearances between phases and to "earth" in excess of B.S.I. recommendations. Stationary contacts are of the spring-loaded, self-aligning wedge-type engaging movable V-shaped contact bars, thus providing two breaks per phase. Large renewable arcing contacts are fitted, all main and auxiliary contacts being composed of hard-drawn, high-conductivity copper. Overload trip coils are of the direct-acting series type, designed to secure the maximum thermal capacity and to withstand heavy short-circuit currents. The coils are calculated to operate at various predetermined overload values, and can be provided with time lags having true inverse time current characteristics or definite adjustable time settings for use where two or more circuit breakers are connected in series. A device may also be incorporated to discriminate between a permanent and a transient fault, so as to lock out the circuit breaker if the fault has not cleared itself after the first reclosing operation. We are told that the circuit breaker has been submitted to endurance tests in which the conditions far exceeded the worst that can arise in practice. Care has been taken to employ suitable materials. All bearings are made of gun-metal to avoid undue friction; all working parts exposed to the atmosphere are composed of non-ferrous metal, or are heavily galvanised by the hot process, while the tank and upper chamber are well covered with rust-preventing paint before the finishing coats are applied. To guard against unauthorised operation provision is made for padlocking the trip handle.

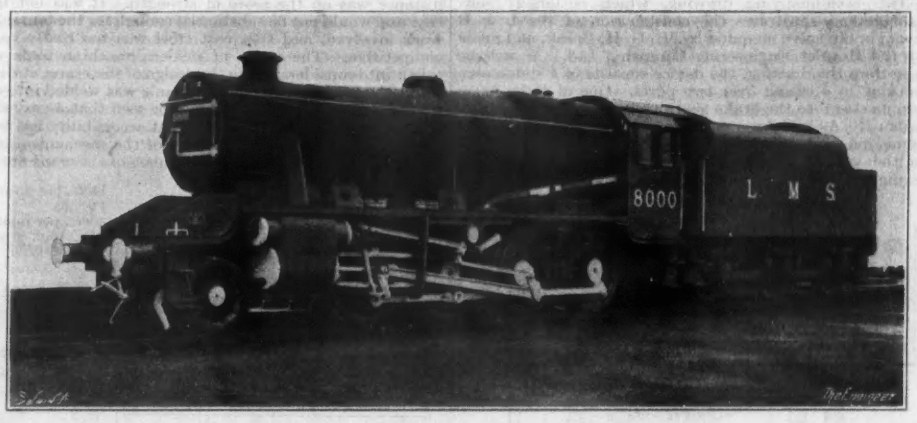
New L.M.S. Freight Engine.

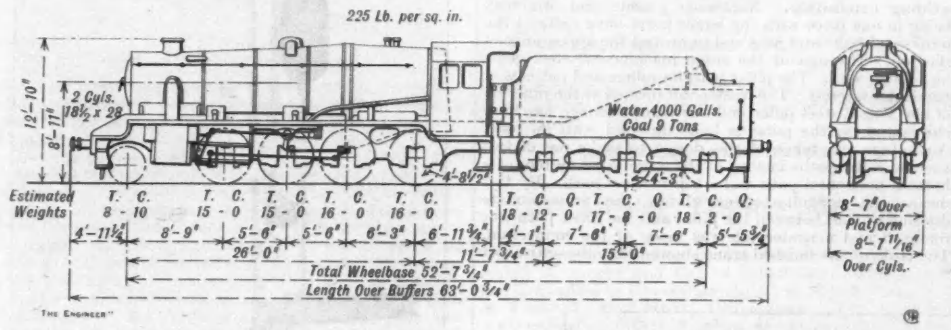
TWELVE new 2–8–0 superheater two-cylinder tender engines are being built at the Crewe Works to the designs of Mr. Stanier. They will be numbered 8000 to 8011 inclusive and the first of the series, No. 8000, has just been put into service.

They have been designed to meet heavy freight requirements and to work over the whole of the company's main line freight routes.

The principal particulars are given in the diagram and table below, and it is only necessary to add that the piston valves have a long travel (6½in.), and, like the cylinders, are provided with mechanical lubrication with steam atomiser to each point of delivery on the steam chests. The piston-rod packings, which are of cast iron, and valve spindle bushes are also mechanically lubricated by lubricators of the company's standard type.

L. M. S. FREIGHT LOCOMOTIVE





2–8–0 *Freight Engine.*

Boiler:	
Barrel	12ft. 10 1/16 in.
Diameter outside	5ft., increasing to 5ft. 8¼in.
Fire-box:	
Outside fire-box	9ft. 3in. by 4ft.
Inside	8ft. 4 15/16 in. by 3ft. 2½in.
Height	8ft. 9 5/32 in. and 7ft. 2 7/32 in.
Tubes:	
Superheater elements	21, 1½in. dia. outside, 11 S.W.G.
Large tubes	21, 5½in. dia. outside by 7 S.W.G.
Small tubes	136, 2in. dia. outside by 11 S.W.G.
Between tube plates	13–3
Heating surface:	
Tubes	1308 square feet
Fire-box	155 square feet
Superheater	235 square feet
Total	1463 square feet
Grate area	27·8 square feet
Tractive effort at 85 per cent. b.p.	32,438 lb.
Adhesion factor	4·28
Weights:	
Light	—
Engine loaded	70 tons 10 cwt.
Tender loaded	54 tons 2 cwt.
Total	124 tons 12 cwt.
Radius of minimum curve	6 chains (or 4½ chains dead slow)
Brake, per cent. engine and tender	64·23

The coupling and connecting-rods are of high-tensile manganese molybdenum steel; the latter of a fluted and the former of a rectangular section.

The balance weights for the coupled wheels are built up of steel plates on both sides of the spokes and riveted, the requisite weight being provided by filling the space between the plates with lead.

Each of the coupled wheels has an independent mechanical oil feed to the crown of the box with a standard back-pressure valve and flexible oil pipe connection.

All the laminated bearing springs for the engine and tender are made of silico-manganese steel, the plates being of a ribbed section with rivet fixing in the buckle for coupled springs, and cotter type fixing in buckle for pony truck springs. The spring links are screwed to permit of adjustment.

The two-wheeled truck is of the Bissel type, with the anchor pin attached to a cross stretcher between the main frames 6ft. 7¾in. behind the truck wheel centre.

The weight on the truck is taken through side bolsters, and the side check spring gear has been carefully arranged to ensure smooth riding.

Mechanical Sanding.—The sanding is of the trickle type, the sand being delivered to the front of the leading coupled wheels and the front and back of the driving wheels. A water de-sanding apparatus is provided, which comes into action simultaneously with the application of sand to the rails, so that after the engine has used the sand the rails are automatically cleaned with hot water to prevent interference with the track circuits.

American Engineering News.

Ready-Mixed Concrete.

THE business of supplying American contractors with concrete made at central mixing plants appears to be steadily increasing, mainly, of course, in or near cities where a considerable and varied amount of construction work may be relied upon. The concrete is proportioned mechanically to suit the specifications in each case, and may be mixed entirely or partly in special "agitator" truck bodies while being transported to the site of the building, pavement, or other work. At one large plant employing truck mixers, cement is received in bulk in railway cars or motor trucks, and is discharged through spouts leading to pipes through which the cement is blown by compressed air to an elevated storage bin. Special cements in bags are handled by a belt conveyor. Aggregates are dumped into a hopper or bin which feeds a belt conveyor, this, in turn, delivering to vertical chain-bucket elevators which supply the cylindrical storage bins. The materials are delivered through automatic weighing machines to the motor trucks, the proportions being adjusted to meet the requirements of the specifications. When the aggregates have been loaded into the truck, cement and water are added, and the truck proceeds on its way, all mixing being done during the trip to the place of delivery. The mixing apparatus is driven by a petrol motor independently of the motor that drives the truck. While most of such concrete manufacturers serve contractors of the larger class on works requiring hundreds or thousands of cube yards, one concern makes a specialty of serving the smaller contractors, who may require only 5 to 50 cubic yards at a time. The firm's engineer visits the job in advance to see that all is ready and that the proper grade or quality of concrete has been ordered. For such small work, the concrete is generally specified as 1:2:3 or 1:2:4, but the company has tables based on the character of its own analyses so as to give the scientific proportions corresponding to the arbitrary proportions ordered.

Relief and Recovery in America.

With the Act for nearly five billion dollars for work relief passed by the United States Congress and signed by the President, its success in affording relief and promoting recovery depends upon the administration of the law, although it is obvious that political influences will hamper and partly control the distribution of the funds. Fundamental principles that will determine the eligibility of the projects submitted have been stated as follows:—First, the projects must be useful; secondly, they must be of such nature that a large proportion of the money will be spent as wages for labour; thirdly, preference will be given to projects which promise ultimate return of a large proportion of the cost to the Federal Government; fourthly, funds allotted must be spent promptly and not held for work in later years; fifthly, all projects must be such as to give employment to those on relief pay rolls; sixthly, projects will be allocated to districts or relief areas in relation to the number of workers on relief pay rolls in those areas. The main part of the fund is allocated to certain classes of work, as follows:—

£180,000,000 for loans and grants to projects of the several States, municipalities, &c., where not less than 25 per cent. will be spent for labour.
£160,000,000 for roads, streets, and the elimination of level crossings.
£120,000,000 for the Civilian Conservation Corps.
£100,000,000 for rural rehabilitation and relief, water conservation, irrigation, and land reclamation.
£90,000,000 for housing.
£70,000,000 for prevention of soil erosion and coast erosion, prevention of stream pollution, and for flood control and general river and harbour work.
£60,000,000 for assistance of educational, professional, and clerical persons.
£20,000,000 for rural electrification.

Rebuilding the Brooklyn Bridge.

The Brooklyn Suspension Bridge over the East River at New York, notable for its engineering design and its exceptionally attractive appearance, has now been in constant service for fifty-two years, and although safe enough its maintenance and repair is costly and its traffic capacity is not adequate for present-day demands. No definite plans for its alteration or reconstruction have been adopted, but a report has been made on a proposition for rebuilding the suspended structure in aluminium, but retaining the present four cables and the masonry towers. The main span is 1595ft. 6in. between centres of towers, with approach spans of 930ft., all suspended from the cables. For reconstruction, the proposed plans include a double-deck bridge with six traffic lanes on each deck, only vehicular traffic being accommodated. Four stiffening trusses—instead of the present six—with floor beams or cross girders of plate girder type, 15ft. apart, would be entirely of rolled sections of aluminium alloy. Upon the cross girders would be laid rolled channels of the same material, spaced 8in. apart and connected by transverse rolled channels riveted to their bottom flanges at intervals of 3ft. 9in. A ⅜in. deck plate riveted to the tops of the longitudinals would form the wearing floor, protected by some composition surfacing. While the dead load of 8400 lb. per linear foot would be about the same as at present, the traffic capacity would be greatly increased. At present there are two 18ft. roadways—each with a tramway track, two lines of rails for local electric trains, and a central walk about 15ft. wide. A radical change in the design is the use of vertical hangers exclusively, eliminating the diagonal stays which radiate fanwise from the towers and give a distinctive appearance to the existing bridge.

Groins for Beach Protection.

Serious erosion of the sandy beach of Lake Michigan, near Milwaukee, by heavy waves of storms from the north and east, has averaged an encroachment of nearly 2ft. annually, with consequent undercutting and landslides of the high clay and sand bluffs or cliffs behind the beach. To check this destructive action, groins have been built about 225ft. long and 200ft. apart. They are of a peculiar type, built of concrete blocks so shaped and laid as to leave a considerable area of opening through the structure, instead of constituting a solid mass. The theory of this permeable design is that it will not interrupt the southward drift of sand and will cause the sand to be deposited along both sides of the groins, thereby improving the beach and also its appearance. With solid groins along that coast there has been a filling up on the north side, but a loss of sand along the south side. The area of opening is greatest in the deep water end of the groin, and diminishes towards the shore, while that part across the beach is practically solid. The width of the groin is 6ft. at the top and 14ft. at the bottom near the outer end. The blocks or beams are laid transversely and fastened together by dowels or vertical rods. They weigh from 1 to 3 tons each, according to length, and are placed by a petrol crane mounted on crawlers and travelling on the beach. Permeable groins of other designs have been used in Florida. The principle is not quite the same as the permeable groins or jetties of trees, wire entanglements, steel frames, and other designs that have been used extensively to prevent the cutting or erosion of river banks. These river protection works are intended to catch the floating driftwood and so check the current that the mud, silt, and sand will be deposited to form a foreshore.

The Western Pumping Station, Pimlico.

By J. FOSTER PETREE, A.M.I. Mech. E.

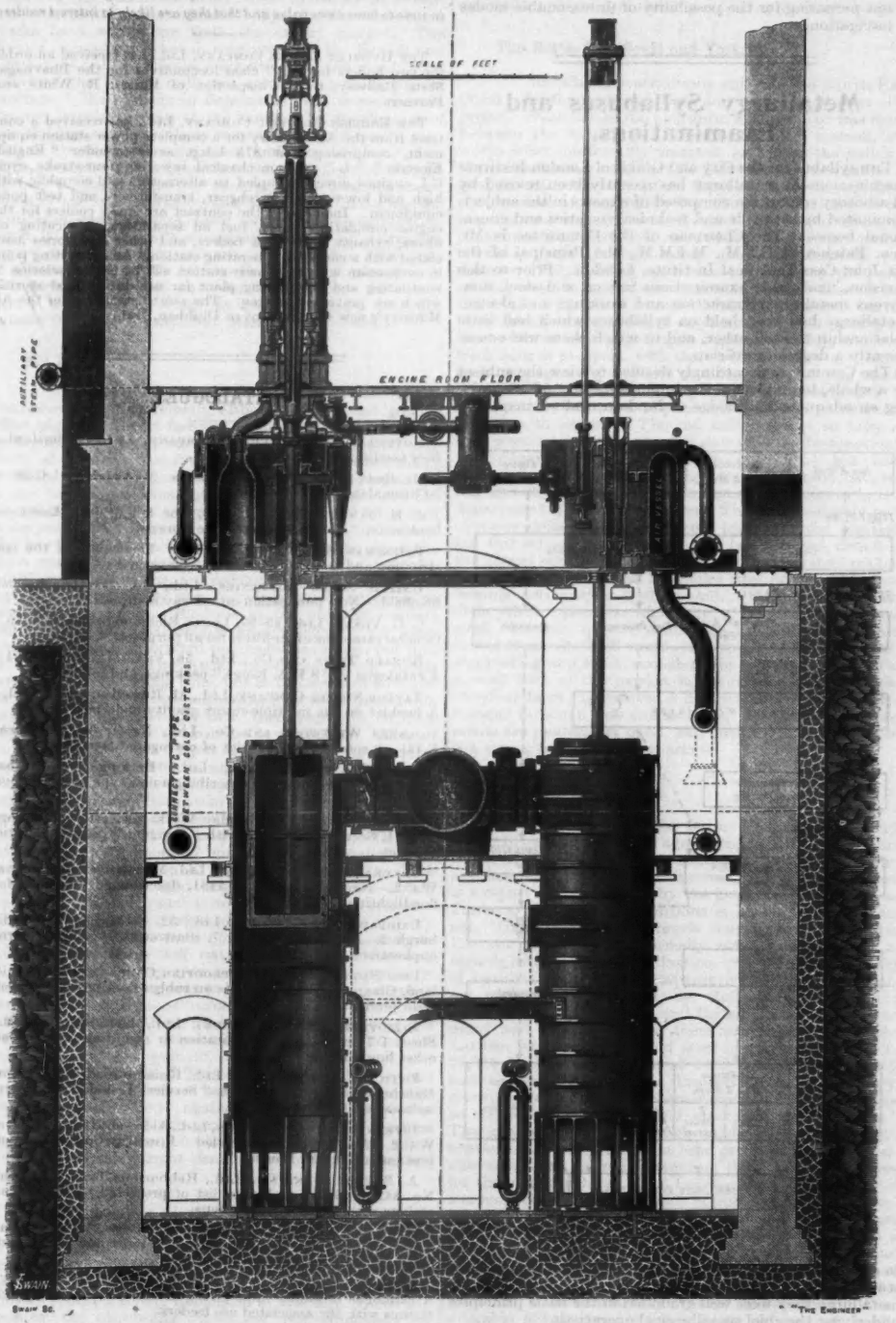
AT 2.45 p.m. on Wednesday, April 24th, 1935, the four Watt beam engines in the London County Council's Western sewage pumping station at Pimlico, a familiar sight for nearly sixty years to railway travellers using Victoria Station, completed their final strokes before passing into the hands of T. W. Ward, Ltd., for demolition. Had they remained at work until August 5th, the full sixty years would have been accomplished—a creditable record, even for their long-living species, although less impressive when compared with the 212 years during which beam engines of one sort or another have been almost continuously at work in the small area now bounded by the Victoria approach lines and Ebury Bridge-road.

This neighbourhood, indeed, has several claims on the attention of the engineering historian, having been the site of the old Chelsea Waterworks before the Brighton Railway extended across the Thames to its new terminus, built over the basin of the Grosvenor Canal in the late 'fifties. The waterworks started operations in 1723–24, with Newcomen engines, housed in a building constructed with the materials of the former church of St. Martin-in-the-Fields, pulled down in 1721. Boulton and Watt engines followed, to be superseded in turn by more modern plant; and in 1829, on land now covered by the railway, the pioneer slow sand filter was laid down to the designs of James Simpson, whose engine works still stands in Grosvenor-road, though now devoted to other purposes.

The opening of the Western pumping station by Lieut.-Colonel Sir James Macnaghten Hogg, Chairman of the Metropolitan Board of Works, took place on August 5th, 1875, and marked the completion of Sir Joseph Bazalgette's great scheme for the main drainage of London, begun in 1856. Of the three main sewers on the north side of the Thames, the Northern High Level and Middle Level were sufficiently elevated to drain by gravitation to the outfall at Barking; but this was not possible in the case of the Northern Low Level sewer, which follows more closely the course of the river, and pumps were therefore provided at Pimlico and Abbey Mills to lift the sewage at these points and enable the gravitational flow to continue. Abbey Mills, opened on July 30th, 1868, raises it 37ft., and the Pimlico station 18ft., both stations being also arranged to pump storm water direct to the river if necessary.

The first stone of the Western pumping station was laid on July 26th, 1873. The main building stood on land reclaimed from the river by the construction of the embankment, and the site, of about 4 acres, extended back between the railway and the Grosvenor Canal on the former waterworks land. Here the auxiliary pump house was built, together with workshops, accommodation for the superintendent and staff, and settling ponds for the boiler feed water, drawn from the river. The contract for the buildings, &c., amounted to £126,955, a further £56,789 being allocated to the pumping machinery, the whole of which was supplied by James Watt and Co., of Soho, Birmingham.

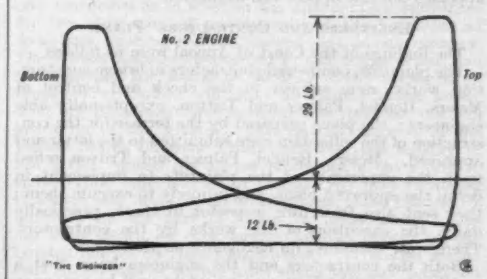
As erected, the plant comprised five pumping engines with ten Cornish boilers, 6ft. 9in. diameter and 22ft. long, with flues 2ft. 7in. diameter. Eight of the boilers supplied the four engines in the main building and the other two served the auxiliary engine, placed in a smaller building at the rear. The working pressure was 35 lb. per square inch. In 1900–01 the original boilers were replaced by four of the Lancashire type, 8ft. diameter and 30ft. long, with 3ft. 2in. furnaces, working at 42 lb. per square inch, though designed for 150 lb., and fitted with Lowcock economisers. The auxiliary engine was horizontal, with a cylinder 28½in. diameter and 5ft. stroke, fitted with an expansion valve of interesting design, but, it was said, rather doubtful efficacy. The engine, which was rated at 74 h.p., drove two single-acting bucket pumps, 48½in. diameter and 5ft. stroke at 9½ strokes per minute, through a 3½ : 1 reduction gear, and had a gross capacity of 35 tons per minute. This set was intended for emergency service, and in recent years was seldom used. It was dismantled about eighteen months ago to make room for the temporary vertical-spindle Allen centrifugal pumps, which are maintaining the duty of the station during the replacement of the main plant.



BEAM ENGINE DRAINAGE PUMPS IN WESTERN PUMPING STATION—1873

The "four principal double-acting high-pressure condensing beam engines," to quote the specification as given in THE ENGINEER of August 15th, 1873, stood in pairs, back to back, in the main engine-house, and were single-cylinder machines, with cylinders 37½in. diameter and 8ft. stroke, each driving a pair of single-acting pumps with plungers, 5ft. 3½in. diameter, and a stroke of 4ft., arranged as shown in the woodcut reproduced on this page. A descriptive pamphlet issued at the time of the opening of the station credited the main engines with 90 h.p. each and the auxiliary horizontal engine with 120 h.p. instead of the 74 h.p. previously mentioned; but the latter figure is the official rating given in the staff handbook containing "particulars of machinery" compiled some thirty years later, and in this publication the main engines are stated to have developed 71 h.p. each at 10·4 strokes per minute. The corresponding gross capacity of the pumps was 52 tons per minute, although in practice somewhat less was usually maintained. On occasion, however, the plant was well able to rise to an emergency, and on the day of the Thames floods, January 6th, 1928, the station pumped 140,000,000 gallons in excess of its normal daily quantity.

In design the main engines possessed several features of interest. Steam distribution was by cam-operated double-beat valves, the cam shaft being driven through bevel gears from the crank shaft. The steam cam was stepped to give four positions of cut-off and control mechanism, worked by hand wheel from the engine-house floor level, moved the cam shaft axially to bring the desired step of the cam into operation. Typical top and bottom cards are shown below. The actual card is



INDICATOR CARD

marked "steam at engines 41 lbs. sq. in., vacuum 26 ins.," possibly a slip due to the use of the wrong scale. The engines were jet condensing, and formerly had an extensive system of cooling pipes in the sump, which appear in end elevation in the woodcut. These were removed some years ago.

The beams were of somewhat unusual construction, being built of wrought iron plates, to which were riveted cast iron bosses for the various gudgeons. The centres of cylinders and of cranks were 15ft. from the beam centres, and those of the pumps 7ft. 6in., thus giving the pumps half the stroke of the engines. The built-up construction of the beams did not prove entirely satisfactory, some trouble being experienced with rivets working loose in the holes, which, of course, were not drilled and reamered with the accuracy that modern practice would require. Repairs by welding were tried, but as these were only local they led to undue concentration of stresses in the welds, and eventually the method was adopted of cutting out loosened rivets and replacing them by fitted bolts.

A transition stage in engineering materials was well illustrated in these engines, the connecting-rods being of cast iron, the cranks and crank shafts of wrought iron, and the crank pins of steel, according to the specification; which also required that "the main parallel motion shall be designed, fitted, and finished in the most superior manner." The requirement was certainly met, and not only in respect of the parallel motion. The fitting of the cast iron framing of the engines, exposed as the engines were dismantled after being hidden for a full sixty years, revealed workmanship of the kind that is a pleasure to see.

The replacement of the pumping machinery, it is understood, will not involve any exterior alteration to the building, and there seems no reason why the curious roof of solid copper tiles, ¼in. thick, should not weather another century. The panelled square chimney—"very nearly the height of the Monument, being only ten feet short of it," and "a most conspicuous and beautiful object as one comes down the river," according to a chronicler of the 'eighties—is to remain as a ventilating shaft; and the ornate plaques, bearing the monogram of the Metropolitan Board of Works, which adorned the framing of the engines, are to be preserved as the only relics of them.

Acknowledgments are due to Mr. T. Peirson Frank, M. Inst. C.E., Chief Engineer to the London County Council; to Mr. J. F. Breeze, M.I. Mech. E., Divisional Engineer (Mechanical); and to Mr. R. Thomlinson, A.M.I. Mech. E., superintendent at the Western pumping station, for the facilities afforded by them to record these details of the last single-cylinder beam engines in the London main drainage system.

THE director of cleansing of Glasgow recently said that last year the Glasgow refuse power works produced electricity equivalent to 31,000 tons of coal from the town's refuse.

Care in Cofferdam Construction.

THE judgments delivered recently in the Court of Appeal, comprising Lords Justices Greer, Maugham, and Roche, in the case of Dorman, Long and Co., Ltd., *v.* William Cory and Son, Ltd., contain data of wide general application, transcending in importance to engineers and contractors the decision in the particular case.

EXCAVATION DEPTH.

Dorman, Long and Co., Ltd., constructional engineers, claimed damages against William Cory and Sons, Ltd., for negligent use of one of their barges, before Mr. Justice Branson. The plaintiffs were under contract with the West Ham Corporation in the construction of a bridge over the (western) entrance of the Victoria Docks, which necessitated the construction of a cofferdam. They contracted with the defendants for the supply of barges for the removal of the soil excavated from the cofferdam. They alleged that one such barge, the "Turk," was brought up to the cofferdam one day so negligently as to come into violent impact with, and to cause the collapse of, the cofferdam. The defendants alleged that adequate protection for the cofferdam had not been provided, and that such omission, and not a collision by the barge with the structure, was responsible for the accident; they further alleged that the plaintiffs had been guilty of contributory negligence in not providing a safe berth for the barge; thirdly, they alleged that the cofferdam had collapsed through its own "inherent vice." As to this last line of defence they contended that (1) excavations inside the cofferdam were in excess of the depth authorised by the engineers and excessive in the circumstances; (2) the piling was driven to an insufficient depth, in view of the nature of the strata; and (3) in view of the excavation the strutting was inadequate.

The learned judge having held, after a hearing extending over several weeks, that the collision of the barge caused the collapse of the cofferdam, and that the accident could not be attributed to any other cause or causes, he directed an inquiry to be held to ascertain the amount of damage caused, with a view to compensation in such sum being paid to the plaintiffs by the defendants. The defendants appealed and the appeal was dismissed.

ENGINEERS AND CONTRACTORS' PLANS.

The findings of the Court of Appeal were as follows:—

The plaintiffs, competent contractors in bridge construction works, were subject to the check and control of Messrs. Rendel, Palmer and Tritton, exceptionally able engineers; the plans prepared by the former for the construction of the cofferdam were submitted to the latter and approved. Messrs. Rendel, Palmer and Tritton relied upon the experience of the plaintiffs to implement in detail the approved plans, and properly to execute them; they sent also their own inspector to check, practically daily, the execution of the works by the contractors. There was, therefore, no negligence on that score.

Both the contractors and the engineers knew that a small extra depth of excavation might well be necessary to reach a solid bottom for the piers, and they had no reason to suppose that the cofferdam would be subjected thereby to greater strain than it was calculated to bear.

INSIDE SKELETON.

Inside the cofferdam a wooden skeleton was constructed of struts running across and fastened to face pieces with caps, the sections being laced together so that the bottom was firmly connected with the top so long as it remained undisturbed; the safety of the cofferdam was dependent on the preservation intact of the inside skeleton.

In fact, a thrust occurred upon the top of the basin side of the piles which was of such a nature as to disturb the equilibrium of the inside skeleton.

TESTING TESTIMONY.

The decision of the case depended not upon any revolutionary discoveries in the modern application of physical laws, but upon hydrostatic pressure and strains as familiar, in principle, even to the ancient Greeks. The Court did not require the guidance of theorists as to what may have occurred; many witnesses gave evidence of a direct character, and if they differed in detail from one another that was evidence of the general accuracy of their story, and went to show that it was a genuine version of what took place; for the experience of law courts was that where a story was concocted the testimony of the witnesses who put it forward tended to coincide exactly, each of them with all the others.

A witness who was at the bottom of the cofferdam felt two successive thuds consequent upon the occurrence witnessed by those above. The sides of the cofferdam in the way of the blow immediately began to leak. The theory advanced by the defendants' expert that the blow administered at the top by the barge could not have sufficed to affect the bottom could not be accepted. Three of the stanchions had fallen in immediately; if the blow had sufficed to cause a leak it might well be sufficient to disturb the bearings of the struts and the security of the cofferdam dependent upon the support of the piles.

NEGLIGENCE.

The barge came up against the cofferdam apparently at an angle of 40 deg. to 45 deg., which was a negligent manner of approach. For a cofferdam is unlike a quay; it has no wall of earth supporting it behind; being hollow, it must be approached with care, and expert navigators testified that reasonable care in such a case involved a broadside approach; pressure at the top all along the line of the barge will then be resisted by the tie-rods whereby the cofferdam is fixed at the top to the quay; whereas an approach at an angle puts the whole force of impact on one portion of the structure.

Negligence means absence of diligence. A reasonably diligent method of procedure, involving the employment of sufficient men, would have been to bring the empty barge alongside the full barge, parallel to it, and then to take out the full barge, and then the empty barge should have been warped in slowly against the cofferdam. The full barge seems to have been pushed out to make room for the empty barge to come along, and thus the empty barge was put in a position to inflict the angular blow, and the whole had collapsed within a quarter of an hour. The evidence was inconsistent with a suggestion that the barge was pushing its nose between the full barge and the quay.

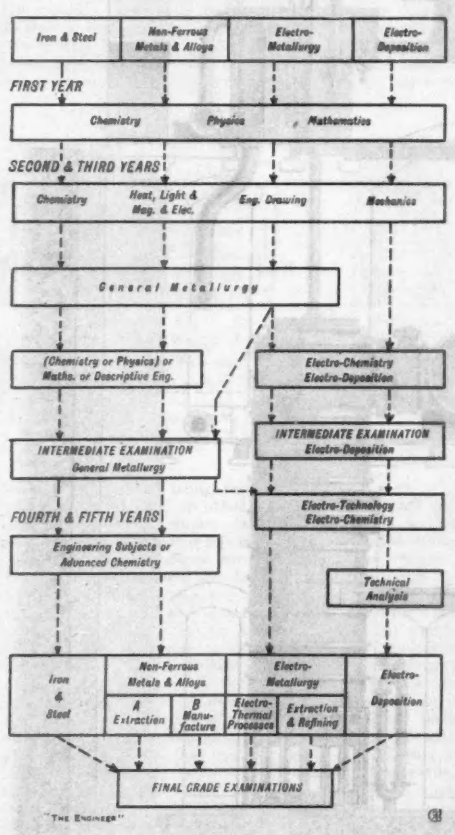
Even assuming that there had been a slight weakening of the cofferdam, consequent upon the additional depth of something like 2ft., if the blow from the barge had not occurred, the life of the mechanism would not have been affected; it was temporary, to take the pier foundation shortly to be put in; the accident occurred during the seventh week of the work, after the excavation had been carried on for about four weeks. What other unusual occurrence could be pointed to in order to account for the disturbance in the equanimity of the mechanism? Theoretical evidence as to what might have caused the trouble if there had been no impact was to be subordinated to direct evidence as to what was seen and heard by the men on the spot.

The plaintiffs had done as much as they were obliged to do, in erecting a cofferdam so constructed as to be capable of withstanding ordinary shocks such as may be expected to occur in the course of bringing barges alongside. There was no contributory negligence on their part in not preparing for the possibility of unreasonable modes of navigation.

Metallurgy Syllabuses and Examinations.

THE syllabus for the City and Guilds of London Institute examinations in metallurgy has recently been revised by an advisory committee composed of experts in the subject, nominated by scientific and technical societies and educational bodies. The Chairman of the Committee is Mr. Geo. Patchin, A.R.S.M., M.I.M.M., the Principal of the Sir John Cass Technical Institute, London. Prior to this revision, final-grade examinations in iron and steel, non-ferrous metallurgy (extraction and working) and electro-metallurgy had been held on syllabuses which had little relationship to each other, and in which there was consequently a degree of overlap.

The Committee accordingly decided to view the subject as a whole, to emphasise the importance of students gaining an adequate knowledge of fundamental sciences, and



to ensure, if possible, that before proceeding to specialised study of one of the branches of ferrous or non-ferrous metallurgy they were well grounded in the basic principles underlying the chief metallurgical operations.

The adoption of this policy necessitated the introduction of an intermediate examination based on a syllabus common to all branches of metallurgy, and the planning of grouped courses of study extending over five years, such courses to include suitable ancillary subjects.

The diagram above shows clearly how the Committee dealt with its task of producing a scheme which its members hoped would conduce to the better training of those actively engaged in or associated with the metallurgical and allied industries.

A study of the complete syllabus for the final-grade examination shows that considerable emphasis has been placed on physical metallurgy, which, as is well known, is of great value to the engineering industry. This part of the subject deals largely with the relationship between the chemical, physical and mechanical properties of metals and alloys including alloy steels, copper, aluminium, nickel, and other non-ferrous alloys, and also the effect of mechanical and thermal treatment on the constitution and properties of these materials. Further emphasis has also been given to the subject by arranging that in the final examination a first paper upon physical metallurgy, including metallography, pyrometry, heat treatment, physical testing and microscopic examination shall be common for all candidates taking either ferrous or non-ferrous metallurgy. Separate second papers, however, are provided with questions set upon (i) iron and steel, (ii) non-ferrous metals and alloys (extraction), and (iii) non-ferrous metals and alloys (manufacture), thereby allowing students to concentrate on a special subject. The final examination of the Institute in either electro-thermal processes or electrolytic extraction and refining consists of a question paper for each section with one part of each paper comprising general questions on electro-technology and electro-chemistry.

Another point of importance to which attention may be directed is that all the final-grade courses should include a reasonable amount of practical work in the laboratory.

CONTRACTS AND ORDERS.

The Editor is always happy to print short announcements of contracts and orders in this column provided they are sent to him in time to have news value and that they are likely to interest readers.

THE HUNSLET ENGINE COMPANY, Ltd., has received an order for two boilers for "F" class locomotives for the Bhavnagar State Railway, to the inspection of Messrs. R. White and Partners.

THE ENGLISH ELECTRIC COMPANY, Ltd., has received a contract from the Air Ministry for a complete power station equipment, comprising four 875 b.h.p. seven-cylinder "English Electric" "L" type mechanical injection four-stroke cycle C.I. engines directly coupled to alternators and complete with high and low-tension switchgear, transformers and test pond equipment. Included in the contract are spray coolers for the engine circulating water, fuel oil separators, lubricating oil filters, exhaust waste heat boilers, and other accessories associated with a complete generating station. An interesting point in connection with the power station will be the installation of ventilating and air filtering plant for use during dust storms, which are prevalent in Iraq. The power station is for the Air Ministry's new Cantonment at Dhibban, Iraq.

CATALOGUES.

HOFFMAN MANUFACTURING COMPANY, Ltd., Chelmsford.—New needle roller bearing list.

G. BRAY AND CO., Ltd., Leeds 2.—Catalogue C-26 of "Chromalox" heating elements.

J. H. SANKEY AND SON, Ltd., The Hill, Ilford, Essex.—A booklet on "Pyruma" plastic fire cement.

PRIESTMAN BROTHERS, Ltd., Hull.—Particulars of the construction and uses of the "Cub" excavator.

UNITED STEEL COMPANIES, Ltd., 17, Westbourne-road, Sheffield.—New publication on railway materials.

C. G. VOKES, Ltd., 95–97, Lower Richmond-road, S.W.15.—General catalogue of air filters for all purposes.

RONALD TRIST AND CO., Ltd., 56, Victoria-street, S.W.1.—A catalogue of "S.E.A. Rings," packings, and jointings.

TAYLOR STOKER COMPANY, Ltd., 31, Russell-square, W.C.1.—A booklet on the multiple-retort gravity-underfeed stoker.

JOSEPH WESTWOOD AND CO., Ltd., Napier Yard, Millwall, E.14.—A specification booklet of corrugated steel flooring.

SCOFFIN AND WILLMOTT, Ltd., Barking By-pass-road, Barking, Essex.—A leaflet describing a new type of steel shovel-barrow.

GENT AND CO., Ltd., Faraday Works, Leicester.—Catalogue Book I, Section I, dealing with "Tangent" general electrical products.

GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, W.C.2.—New publication, F 7151, describing "Osira" colour floodlighting.

LAIDLAW, DREW AND CO., Ltd., 52, Frederick-street, Edinburgh 2.—Catalogue Section 7, illustrating typical oil burner applications.

IOCO RUBBER AND WATERPROOFING COMPANY, Ltd., Anniesland, Glasgow, W.3.—Booklets on rubber flooring and synthetic resin products.

ELLIOTT BROTHERS (LONDON), Ltd., Lewisham, S.E.13.—Sheet T 7 on the remote indication or recording of water and other liquid levels.

SWITCHGEAR AND COWANS, Ltd., Elsinore-road, Old Trafford, Manchester.—A new booklet "Service Tested," on internal isolation switchgear.

INTERNATIONAL COMBUSTION, Ltd., Aldwych House, Aldwych, W.C.2.—A new brochure entitled "Primarily Concerning Combustion and Steam Raising."

A. REYROLLE AND CO., Ltd., Hebburn-on-Tyne.—Pamphlet No. 842, an illustrated price list of protected type plugs and sockets with earthing connections.

GASTON E. MARBAIX, Ltd., Vincent House, Vincent-square, S.W.1.—A circular describing the "Sundstrand" 6in. automatic and semi-automatic stub lathe.

FRASER AND CHALMERS ENGINEERING WORKS, Erith, Kent.—A catalogue of stamp mills giving details and sizes of gravity stamps with the associated ore feeders.

FERGUSON, PAILIN, Ltd., Higher Openshaw, Manchester.—A leaflet describing the firm's current limiter and a brochure on the type K oil circuit breakers for industrial use.

F. J. EDWARDS, Ltd., 359–361, Euston-road, N.W.1.—Silver Jubilee stock list No. 83505, containing particulars of sheet metal-working machines, both new and reconditioned.

ASSOCIATED EQUIPMENT COMPANY, Ltd., Southall, Middlesex.—Literature describing the range of improved lightweight A.E.C. goods vehicles, to be distinguished by the appendix Mark II.

THOMAS SMITH AND SONS (Rodley), Ltd., Rodley, Leeds.—Catalogue 2650, giving particulars of a wide range of hand-operated cranes made by the firm, and a leaflet describing a quarter-yard excavator.

BRUSH ELECTRICAL ENGINEERING COMPANY, Ltd., Loughborough.—Publications No. B5 on "Motor Converters"; No. G7, general illustrated list of the firm's products; and C1, on Ljungström turbo-generators, for outputs up to 8000 kW.

IOCO RUBBER AND WATERPROOFING COMPANY, Ltd., Anniesland, Glasgow.—Particulars of "Formapex," a magnetic slot wedge material designed for closing the slots of stator cores or other slotted core-carrying members of electro-magnetic machines.

Markets, Notes and News.

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quotations are f.o.b. steamer. A comprehensive list of the prices of materials mentioned below will be found on the next page.

The International Steel Trade.

The home markets in most of the iron and steel-producing countries appear to be affording more support to the industry than the export trade, and this is conspicuously the case in Great Britain and Germany. In this country the home demand provides by far the greatest outlet for iron and steel materials of all descriptions, and in Germany the activity of the building trades and Government and municipal development plans have absorbed large quantities of steel. The extent of the increase in the domestic home market is indicated by the fact that the turnover for the first five months of the current year was 19 per cent. greater than for the corresponding period of 1933. German export sales, however, including the quantities disposed of by barter in foreign markets, have been considerable, and for the time being works have withdrawn from the export market. The French domestic market in contrast with the British and German is only moderately active, with the result that many of the French mills are anxiously seeking export business. The position in Belgium is even worse than in France, largely because at the time of the devaluation of the Belgian currency there were exceedingly heavy purchases by domestic consumers and stockholders. The mills, therefore, are in a position of making heavy deliveries against contracts, but are booking little fresh business. Some of the steel works outside the Cartel, including the Hungarian steel makers, have made themselves troublesome lately, and have competed keenly for attractive export business. For instance, an order for 2500 tons of plates for the South African Railways was placed with Hungarian works, and an order for steel rails for South Africa was recently taken by the Canadians, who are outside the International Rail Makers' Association.

Pig Iron.

The assured outlook resulting from the Anglo-Continental steel agreement, although it does not greatly affect pig iron, has an indirect influence upon the market by securing to the home manufacturers of finished products, of which pig iron is the raw material, a substantially increased output. Signs that more interest is being taken in the market are apparent in many directions, and the general belief in the pig iron trade is that in the latter half of the year there will be an important expansion in demand. The North-East Coast makers are concentrating upon the home market, and excepting in the case of a few old-established connections, are paying little attention to the export trade in foundry iron, for which unattractive prices have to be accepted. Business at the moment consists principally of small parcels for prompt delivery, but some inquiries relating to forward purchases have been put into circulation lately. The stocks in the producers' hands have been low for a long time, but at the moment it would seem that there is a nice adjustment between production and consumption. At any rate, there seems to be little immediate prospect of an increase in production. Most of the North-East Coast output is being taken up by local users, but steady deliveries are being made to Scotland. The approaching July holidays, however, and the competition experienced from other makes of iron have affected the Cleveland market in that district. The situation of the Midland producers of pig iron is satisfactory. There is not much forward booking, but the sales of small parcels for near delivery reach a respectable aggregate. The requirements of the light castings industry are slowly expanding, but this branch is not working at high pressure. Some of the contracts booked early in the year for delivery up to the end of June have not been completed, and the undelivered balances will have to be carried forward. In the Lancashire pig iron market business is steady. The large consumers appear to have covered their requirements for some time to come, and present indications point to a continuation of hand-to-mouth buying for two or three months. Some users, particularly the textile machinists, are not well off as regards work, and this makes a considerable difference to the market in this district. No special feature has developed in the hematite market. Specifications against contracts continue to reach the works on a substantial scale, but new business has been rather disappointing. The producers state, however, that the current demand is slowly reducing the stocks.

The Midlands and South Wales.

The improvement noticeable during the past fortnight in the demand for finished steel in the Midlands has been more than maintained. Most branches of the industry report a steady expansion in business. Generally speaking, the consuming trades are well employed, but have not experienced the increase in the demand for their products which was expected to follow the agreement with the Cartel. This is probably because there still remain stocks of Continental steel to be liquidated, and old contracts which have to be worked off. No new business in Continental material is possible, but it is expected that sellers will reopen their books in the early part of July for delivery after August 7th. Most consumers continue to follow a policy of buying only for prompt delivery, and some irritation is expressed by steel makers at this attitude. There has been a considerable amount of buying lately by constructional engineers, but many of them covered their requirements a month or two ago, and have good quantities to receive against contracts. The plate mills are not so well off as regards business in hand as other departments. Orders for thick plates, in particular, are scarce, whilst mild steel chequer plates are in only moderate request at £10 7s. 6d. The sheet makers are experiencing an improvement in demand. The home trade in this department is active, and lately some of the overseas markets have been showing more interest. The situation in the galvanised sheet market, however, is far from satisfactory. The requirements of home consumers are on a fairly satisfactory scale, but the British makers' export trade has been badly cut into by Belgian makers, who have extended their competition recently to markets which the British for a long time have considered their own preserve. The markets in South Wales have benefited in common with other districts from the changes which have taken place recently in the steel trade. In this district, however, so much depends upon the condition of the tinplate industry that the improvement is less in evidence. The British tinplate makers are still debarred from quoting competitive prices for certain markets until the foreign parties to the International Tinplate Agreement have made good their arrears. The constructional engineers and general engineering works in South Wales are well employed and the ship-repairing yards are busy.

The North-East Coast and Yorkshire.

Satisfactory conditions rule on the North-East Coast. All the works are busy and have a good reserve of orders. Even before the long-term arrangement was made between the British and Continental steel makers, the works were comfortably situated, and since the holidays there has been a considerable increase in the volume of new orders. One of the first departments to benefit from the removal of uncertainty regarding the outcome of the negotiations was the semi-finished steel department, as consumers who were well covered had to a certain extent refrained from placing orders until the situation was definite. Shipbuilding orders are not reaching the yards on this coast in any number, and as a result there is not more than a moderate demand from this industry. On the other hand, constructional engineers are well employed. Most of them are engaged upon important orders, and have fresh ones in prospect, with the result that they are taking good tonnages of joists and sections. Engineering establishments also seem to be experiencing a steady flow of orders, and their steel requirements show a satisfactory tendency to expand. The rail mills are not so busy as they were a few weeks ago, but now that the International Rail Manufacturers' Association (I.R.M.A.) has been extended as a result of the general agreement between the British and Continental makers, the situation in this department is likely to improve. The comparatively poor overseas demand is the weakest feature of the position, but this side of the market should benefit when details of the export arrangement with the Continental steel makers have been settled. The Yorkshire steel market has again become active after a short lull, which, however, had little effect upon the high rate of production of basic steel. Slightly quieter conditions rule in some departments of the Sheffield works, as a result of the half-yearly stocktaking and the approach of the holiday season. The general tone of the market is optimistic, and lately the re-rollers have experienced a distinct improvement in the demand for small bars and sections. Special steel requirements are moderately good, and business in stainless steel is a strong feature of the market.

Our Trade with Latvia.

Latvia is one of the Baltic countries with which Great Britain has a trade agreement, and the conditions which British manufacturers have to meet in that country are therefore of considerable interest. These are described in a report recently issued by the Department of Overseas Trade on "Economic Conditions in Latvia," price 1s. 6d. net. Great Britain still heads the list of importers of Latvian produce, but Germany occupies first place as regards exports to that destination. In fact, the summary of Latvian trade makes disappointing reading. Pig iron, for instance, is supplied by Holland, Germany and Russia; lead by Australia and Britain; and zinc by Germany and Poland. Whilst there was an increase in the Latvian imports of iron and steel in 1934, which rose to 29,318 tons, Poland supplied 9402 tons, Belgium 9453, and Germany 3426 tons. Imports from this country, according to the report, "were appreciable only in respect to sheets and tin-plates and amounted to 4275 tons." The interest shown by British exporters in this market, continues the report, has not been great, although favourable conditions existed in securing the majority of orders for these commodities. The Latvian Government created a monopoly in the import trade in iron and steel in November, 1934, and this practically put an end to all private trade formerly transacted with local importers. With a few exceptions relating to certain odd sizes of iron and steel required for special purposes, the sole rights of importation have been conceded to the Libau Wire Works, which is a Government-controlled undertaking. Considerable development work is being carried out in the country, and the Riga Municipality recently placed a contract for new pumps with a British firm approximating £10,000. The establishment of a hydro-electric power plant is expected to be undertaken by the Government, which proposes to utilise its own resources. The Municipality of Libau intends to construct a hydro-electric power plant at a cost of 1,500,000 lats, whilst another hydro-electric power plant is expected to be installed by the Municipality of Rezekne.

Current Business.

A contract for the supply of a second blast-furnace for the South African Iron and Steel Works at Pretoria has been secured by Ashmore, Benson, Pease and Co., Ltd. The value of the contract is £250,000. The constructional work is to begin at the end of this year, and the furnace is expected to be completed by the middle of 1937. It is understood that negotiations are proceeding for the purchase of a section of the Cyclops Works, Sheffield, formerly belonging to Cammell, Laird and Co., Ltd., by Thos. Firth and John Brown, Ltd. This development is the result of the application of Firth-Vickers Stainless Steels, Ltd., of Tinsley, Sheffield, in which the stainless and heat-resisting steel interests of Firth-Brown and the English Steel Corporation, Ltd., have been combined. Belgian wire nail interests are reported to be negotiating for the establishment of a nail works on the North-East Coast. Sir Robert Ropner and Co., Ltd., of West Hartlepool, have placed an order for a 9000-ton motorship with William Doxford and Sons, Ltd., of Sunderland. As the result of negotiations between Harland and Wolff and Workman, Clark (1928), Ltd., and the National Shipbuilders' Security, Ltd., shipbuilding on the north side of the river at Belfast will be discontinued. The shipbuilding and engineering works of Workman, Clark and Co. on the south side of the river adjoining the works of Harland and Wolff will become part of that establishment, and in future the shipbuilding and marine engineering activities of the port will be concentrated at Queen's Island. The Department of Overseas Trade reports that the following contracts are open for tender:—Argentine State Oilfields, road asphalting plant, including an insulated tank of approximately 3000 litres capacity and a pump driven by a petrol motor of 30–35 h.p. (Buenos Aires, July 15th); New Zealand, Posts and Telegraphs Department, 3000 packets of insulated staples, $\frac{1}{8}$in. length and $\frac{1}{16}$in. inside width, and 400 packets of ordinary staples, $\frac{1}{8}$in. long, $\frac{1}{16}$in. to $\frac{1}{8}$in. internal width (Wellington, August 28th); South African Railways and Harbours Administration, ammonia refrigerating plant for a precooling store (Johannesburg, August 6th).

Copper and Tin.

The situation in the copper market changed for the worse last week, but has recovered to some extent. There seem to be serious doubts on the part of dealers and consumers as to whether the international agreement for the restriction of production and the limitation of American exports will be carried out in its entirety. These fears have been reflected in the fall in prices, and the general view seems to be that if the arrangement breaks down values will drop to unprecedented levels. Two circumstances have conspired to prevent the full operation of the scheme. The famous decision of the United States Supreme Court regarding the legality of the N.R.A. robbed the copper producers of the power to enforce their code, and whilst the majority may be willing to accept and work to the arrangement, there has been a tendency on the part of others to break away. This has been shown by considerable sales of copper on the London market by American interests. It is also stated that 20,000 tons of copper exist which was not controlled by the producers, and which may be sold outside the arrangement now that it can be legally done. It is feared that the African producers may consider that if American exports are not limited they are not bound to observe the curtailment of production clauses of the agreement. It is not surprising, therefore, that copper prices have declined, and that consumers are showing less interest in the metal. The position on the London standard market has been governed by these circumstances and unsettled conditions have ruled. There has been substantial liquidation and the bear account seems to be growing. Yet, notwithstanding the obvious difficulties of the situation, there is a section of the market that refuses to believe that the copper producers will not in their own interests keep the agreement. . . . Conditions in the tin market change very little. It remains firmly under control, and both trading and speculation appear to be discouraged. Comparatively little business has been transacted, and neither the United States nor the Continent has bought on any scale. The backwardation of over £12 which developed last week has decreased to about £10 10s.; but this is heavy enough to cause great dissatisfaction in the market.

Lead and Spelter.

No particular development has occurred in the lead market. Sentiment has, of course, been affected by the easier tone in other departments, notably the copper market, and prices have at times displayed a weaker tendency. The undertone of the market has been steady, however, and in spite of one or two lulls in the demand, buying by consumers has on the whole been well maintained. At times selling, partly of a speculative character, was more in evidence than buying, and this naturally influenced prices; but early this week the market began to show a tendency to advance. Consumers still complain of the difficulty they experience in obtaining supplies of Empire lead and substantial premiums are being asked. On the other hand, a number of consumers appear to have covered their forward requirements well ahead and are obtaining regular deliveries. The market apparently expects that the arrangement by which the present duty will be altered to a flat rate will be put into force during the next few weeks; but no official statement has been made. . . . The position in the spelter market, which suffered a setback in prices in common with other non-ferrous metal markets, has improved and a fair amount of buying, some of which was probably speculative, developed over the week-end. Consumers have bought on a fairly good scale in spite of the irregularity in prices. The brass trade seems to be the most important consumer at the moment, although lately the galvanised makers have shown more interest in the metal. The demand for industrial purposes on the Continent also seems to be gradually increasing and sentiment in this market has become more cheerful. American statistics give the world production of spelter in May as 123,807 metric tons. The consumption of spelter for 1934 was placed at 1,144,700 metric tons, compared with 1,013,800 tons in 1933, European consumption being 701,500 tons last year, compared with 591,700 tons in 1933.

Current Prices for Metals and Fuels.

Makers' official home trade prices, per ton, delivered buyers' stations. Sections, joists and plates are subject to a rebate to home users purchasing only from associated British Steelmakers: joists, 22s. 6d.; plates and sections, 15s. Export orders of 250 tons and over may be subject to special quotations.

PIG IRON.

	Home.	Export.
	(*D/d Teesside Area*)	
N.E. COAST—	£ s. d.	£ s. d.
Hematite Mixed Nos.	3 8 6	3 2 0
No. 1	3 9 0	3 3 6
Cleveland—	(*D/d Teesside Area*)	
No. 1	3 10 0	3 4 0
No. 3 G.M.B.	3 7 6	3 1 6
No. 4 Forge	3 6 6	3 0 6
Basic (*Less 5/– rebate*)	3 10 0	—
MIDLANDS—		
Staffs.—	(*Delivered to Black Country Station*)	
North Staffs. Foundry	3 11 0	—
„ „ Forge	3 6 6	—
Basic (*Less 5/– rebate*)	3 15 0	—
Northampton—		
Foundry No. 3	3 7 6	—
Forge	3 2 6	—
Derbyshire—		
No. 3 Foundry	3 11 0	—
Forge	3 6 0	—
SCOTLAND—		
Hematite, f.o.t. furnaces	3 11 0	—
No. 1 Foundry, ditto	3 12 6	—
No. 3 Foundry, ditto	3 10 0	—
Basic, d/d (*Less 5/– rebate*)	3 10 0	—
N.W. COAST—		
Hematite Mixed Nos.	3 12 6 d/d Glasgow 4 0 6 „ Sheffield 4 5 6 „ Birmingham	

MANUFACTURED IRON.

	Home.	Export.
LANCS.—	£ s. d.	£ s. d.
Crown Bars	9 12 6	—
Best Bars	10 2 6	—
S. YORKS.—		
Crown Bars	9 12 6	—
Best Bars	10 2 6	—
MIDLANDS—		
Crown Bars	9 15 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	7 10 0 to 8 0 0	—
SCOTLAND—		
Crown Bars	9 12 6	9 5 0
Best	10 2 6	9 15 0
N.E. COAST—		
Common Bars	9 12 6	8 15 0
Best Bars	10 2 6	9 15 0
Double Best Bars	10 12 6	10 0 0

STEEL.

	Home.	Export.
LONDON AND THE SOUTH—	£ s. d.	£ s. d.
Angles	8 10 0	7 7 6
Tees	9 10 0	8 7 6
Joists	8 17 6	7 7 6
Channels	8 15 6	7 12 6
Rounds, 3in. and up	9 10 0	8 7 6
„ under 3in.	8 14 6	7 0 0
Flats, 5in. and under	8 14 6	7 0 0
Plates, ¼in. (basis)	9 0 0	7 15 0
„ ⅜in.	9 5 0	8 0 0
„ ½in.	9 10 0	8 5 0
„ ⅝in.	9 15 0	8 10 0
„ ¾in.	9 10 0	8 5 0
NORTH-EAST COAST—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Plates, ¼in.	8 15 0	7 15 0
„ ⅜in.	9 0 0	8 0 0
„ ½in.	9 5 0	8 5 0
„ ⅝in.	9 10 0	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates, ¼in.	9 5 0	8 5 0
MIDLANDS, AND LEEDS AND DISTRICT—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 17 6	7 15 0
„ ⅜in.	9 2 6	8 0 0
„ ½in.	9 7 6	8 5 0
„ ⅝in.	9 12 6	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates, ¼in.	9 7 6	7 15 0 to 8 5 0

STEEL (*continued*).

	Home.	Export.
GLASGOW AND DISTRICT—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 6
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 15 0	7 15 0
„ ⅜in.	9 0 0	8 0 0
„ ½in.	9 5 0	8 5 0
„ ⅝in.	9 10 0	8 10 0
„ ¾in.	9 5 0	8 5 0
Boiler Plates	9 5 0	8 5 0
SOUTH WALES AREA—	£ s. d.	£ s. d.
Angles	8 7 6	7 7 6
Tees	9 7 6	8 7 6
Joists	8 15 0	7 7 0
Channels	8 12 6	7 12 6
Rounds, 3in. and up	9 7 6	8 7 6
„ under 3in.	8 12 0	7 10 0
Flats, 5in. and under	8 12 0	8 17 6
Plates, ¼in. (basis)	8 17 6	7 15 0
„ ⅜in.	9 2 6	8 0 0
„ ½in.	9 7 6	8 5 0
„ ⅝in.	9 12 6	8 10 0
„ ¾in.	9 10 0	8 5 0

IRELAND—	BELFAST.	REST OF IRELAND.
	£ s. d.	£ s. d.
Angles	8 12 6	8 15 0
Tees	9 12 6	9 15 0
Joists	9 0 0	9 2 6
Channels	8 17 6	9 0 0
Rounds, 3in. and up	9 12 6	9 15 0
„ under 3in.	9 2 0	9 4 6
Plates, ¼in. (basis)	9 0 0	9 2 6
„ ⅜in.	9 5 0	9 7 6
„ ½in.	9 10 0	9 12 6
„ ⅝in.	9 15 0	9 17 6
„ ¾in.	9 12 6	9 15 0

OTHER STEEL MATERIALS.

	Home.	Export.
Sheets.	£ s. d.	£ s. d.
10-G. to 13-G., f.o.r.	9 0 0	8 15 0
14-G. to 20-G., d/d	10 5 0	9 0 0
21-G. to 24-G., d/d	10 10 0	9 5 0
25-G. to 27-G., d/d	11 2 6	9 17 6

The above home trade prices are for 4-ton lots and over; 2-ton to 4-ton lots, 10s. per ton extra; and under 2-ton lots, 30s. per ton extra.

Galvanised Corrugated Sheets, Basis 24-G.

Home.	£ s. d.
4-ton lots and up	13 0 0
2-ton to 4-ton lots	13 7 6
Under 2 tons	15 0 0

Export: £12 15s. 0d., c.i.f. India.
„ £11 5s. 0d., f.o.b. other markets.
„ Scandinavian Markets free.

Tin-plates.

20 by 14 basis, f.o.b. Bristol Channel Ports, 18/2 to 19/2.

Tin-plate Bars, d/d South Wales Works, £5 5s. 0d.

Billets.	£ s. d.
Basic (0·33% to 0·41% C.)	6 12 6
„ Medium (0·42% to 0·60% C.)	7 2 6
„ Hard (0·61% to 0·85% C.)	7 12 6
„ „ (0·86% to 0·99% C.)	8 2 6
„ „ (1% C. and up)	8 12 6
Soft (up to 0·25% C.), 500 tons and up	5 10 0
100 to 250 tons	5 17 6
Rails, Heavy, 500-ton lots, f.o.t.	8 10 0
„ Light, f.o.t.	7 10 0

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/3 per lb.	
Ferro Tungsten	3/– per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 15 0	7/–
„ „ 6 p.c. to 8 p.c.	£21 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£21 10 0	7/–
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£34 0 0	11/–
„ „ „ 1 p.c. carbon	£36 5 0	11/–
„ „ „ 0·70 p.c. carbon	£37 5 0	12/–
„ „ „ carbon free	9½d. per lb.	
Metallic Chromium	2/5 per lb.	
Ferro Manganese (loose)	£10 15 0 home	
„ Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/– p.u.	
„ „ 75 p.c.	£17 17 6 scale 6/– p.u.	
„ Vanadium	12/8 per lb.	
„ Molybdenum	4/6 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£200 to £205	
Cobalt	5/– to 5/6 per lb.	

NON-FERROUS METALS.

Official Prices, June 26th.

COPPER—		
Cash	£29 5 0 to £29 6 3	
Three months	£29 11 3 to £29 13 9	
Electrolytic	£32 10 0 to £33 5 0	
Best Selected Ingots, d/d Birmingham	£33 10 0	
Sheets, Hot Rolled	£62 0 0	
	Home.	Export.
Tubes, Solid Drawn (basis)	9½d.	9½d.
„ Brazed (basis)	9½d.	9½d.
BRASS—		
Ingots, 70/30, d/d Birmingham	£31 0 0 to £32 0 0	
	Home.	Export.
Tubes, Solid Drawn, 2/1 Alloy	9d.	9d.
„ Brazed	11d.	11d.
TIN—		
Cash	£229 15 0 to £229 17 6	
Three months	£229 5 0 to £220 10 0	
LEAD:	£13 13 9 to £13 15 0	
SPELTER	£13 17 6 to £13 18 9	
Aluminium Ingots (British)	£100	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Grangemouth)—Navigation Unscreened	13/– to 13/6
„ Glasgow—Ell	14/6 to 15/6
„ „ Splint	17/–
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/– to 13/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—	
Prime Steam	13/6 to 14/–
Unscreened Navigation	12/9 to 13/3
LOTHIANS—	
(f.o.b. Leith)—Hartley Prime	12/9 to 13/–
Secondary Steam	12/– to 12/3

ENGLAND.

YORKSHIRE, MANCHESTER—	
B.S.Y. Hard Steams	18/6 to 21/6
Furnace Coke	15/– to 16/–
NORTHUMBERLAND, NEWCASTLE—	
Blyth Best	14/– to 14/6
„ Second	13/3 to 13/6
„ Best Small	10/6 to 11/–
Unscreened	12/6 to 13/6
DURHAM—	
Best Gas	14/8
Foundry Coke	19/– to 20/–

SHEFFIELD—	Inland.	
Best Hand-picked Branch	23/– to 25/–	—
South Yorkshire Best	20/– to 22/–	—
South Yorkshire Seconds	17/– to 18/6	—
Rough Slacks	8/– to 9/–	—
Nutty Slacks	7/– to 8/6	—

SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Admiralty Large	19/6
Seconds	19/– to 19/4½
Best Dry Large	18/9 to 19/3
Ordinaries	18/3 to 18/6
Best Bunker Smalls	13/6 to 14/–
Cargo Smalls	11/6 to 12/6
Dry Nuts	22/– to 26/–
Foundry Coke	24/– to 37/6
Furnace Coke	19/– to 21/6
Patent Fuel	21/–
SWANSEA—	
Anthracite Coals:	
Best Large	36/– to 40/–
Machine-made Cobbles	41/– to 48/6
Nuts	40/– to 48/6
Beans	25/– to 30/–
Peas	19/– to 23/–
Rubbly Culm	11/– to 12/–
Steam Coals:	
Large Ordinary	18/– to 20/6

FUEL OIL.

Inland consumption; contracts in bulk.
Exclusive of Government tax of 1d. per gallon.

Ex Ocean Installation.	Per Gallon.
Furnace Oil (0·950 gravity)	3½d.
Diesel Oil	4d.

French Engineering Notes.

(From our own Correspondent in Paris.)

Sales Comptoirs.

WHEN demand and prices were falling on the eve of what threatened to be a bad slump, producers and merchants got together to discuss an agreement for the maintenance of prices, and arrangements were made to organise stocks of rolled steel held by Paris merchants in a manner intended to economise their charges and place them more directly under the control of makers. The merchants' comptoir provided that each member should stock particular sizes and sections which would be available to all other members, and that, as far as possible, material would be grouped for delivery in areas in and around Paris in order to save the cost of running a number of lorries with light loads. Between merchants and steel rollers there was a binding tariff, with discounts and rebates depending upon the yearly volume of orders and the distances for delivery. Prices were fixed for consumers all over the country. This rigid system worked more or less satisfactorily until the slump became so acute that it broke down. Merchants complained that they were not getting a fair deal, and matters were not improved by a belief that discipline amongst steel makers themselves left something to be desired. Prices dropped heavily, and consumers held off a declining market. As the contract expires this week, producers and merchants are negotiating for its renewal under more satisfactory conditions, but merchants have submitted proposals which makers are reluctant to accept, so that there is a prospect of negotiations being protracted by difficulties that do not offer an easy solution. It is clear, however, that something must be done if a collapse of the home market is to be avoided, and it is probable that the existing contract will be renewed for three months in order to give time for the two parties to settle their differences.

Railway Economies.

Amongst the urgency measures which the Government is undertaking in order to balance the budget is the reduction of the railway deficit, which, for the past three years, has amounted annually to about 4000 million francs. As the State is unable to forego the revenue derived from the railways there is no question of further reducing the heavy load of taxation on passenger and goods transport, and the only way open for dealing with the problem is to carry immediately into effect those plans of economic organisation already devised that would normally take a considerable time to materialise. In the first place, there is to be drastic economy in the administrative services. They are to be simplified and the rigid system of railway rates will give way to a more adaptable method that will facilitate relations between the railways and users, while further economies will be realised in the working of local lines with light traffic. All this means a reduction in the number of railwaymen and employees. These economies are expected to lessen the deficit by 1250 million francs. Railway expenditure is to be reduced by standardising rolling stock, as well as by ensuring that locomotives render their most efficient service. Of particular interest are instructions given to Prefects in all departments to refuse permission to run new road services for public transport. At the same time, the Government has decided that all arrangements for the co-ordination of road and rail transport throughout the country must be completed before the end of the year. Recently, the conditions under which this co-ordination has to be effected were embodied in a law providing for the creation of a technical committee in each department that would arrange for the collaboration of the railway company and the road hauliers, whose number would be strictly limited to the requirements of users within each department. The railway companies are not allowed to run public service vehicles, except in special circumstances, and road services continue to be exploited by those who initiated them, though under conditions that entail obligations towards the railways with respect to services and fares. The road hauliers are subservient to the railways so far as traffic within the department is concerned. This organisation has made a good deal of progress and has proved satisfactory in working; but there remains so much to be done that, under normal conditions, its completion would take a very long time, particularly in view of the claims of road hauliers who are represented by a powerful association, supported by the motor car industry. The Government has, therefore, ordered that all the departmental technical committees shall be constituted without delay throughout the country, and a date has been fixed for agreements between the railway companies and the road hauliers to be submitted to the central co-ordination committee at the Ministry of Public Works, which has to examine and approve such agreements based upon general lines, more or less modified to meet local requirements. There still remains the problem of long-distance public road transport, which competes seriously with the railways, and where the railways can deal more economically and satisfactorily with the traffic such competition will doubtless be eliminated.

Tunnelling the Vosges.

When Alsace was restored to France, it became an urgent necessity to improve railway facilities between the two sides of the Vosges, which constituted a barrier between Alsace and the neighbouring department, and it was decided to construct two tunnels, one at Sainte-Marie-les-Mines, to connect up the railway from Selestat with the main line between Saint-Dié and Strasbourg, and the other at Bussang, where a direct connection would be made between Mulhouse and Epinal. The Sainte-Marie-les-Mines tunnel was started two years ago and has just been completed. It has a length of a little more than 4½ miles, beginning with a short curve of small radius and then continuing straight throughout, rising about midway to 84·7 m. above the entrance level. Work was carried on continuously day and night. The railway will be inaugurated in May, 1937. This tunnel is the longest in France, but it will be surpassed by the Bussang tunnel now under construction.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

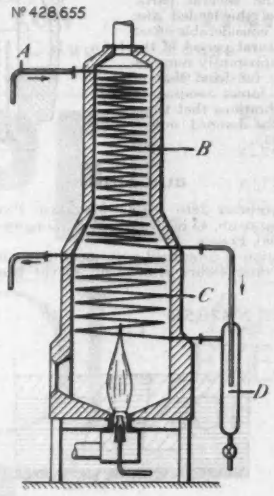
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

428,655. July 18th, 1934.—WATER-TUBE STEAM GENERATORS, Sulzer Freres Société Anonyme, Winterthur, Switzerland.

This is a coil boiler of the type working below the critical temperature of water. The water is fed in at A and is normally

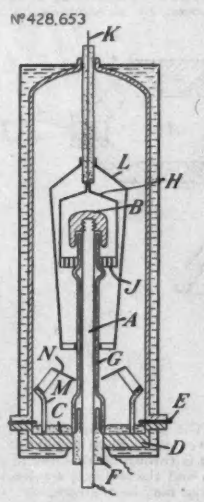


evaporated in the coil B and superheated in the coil C. Should abnormal conditions arise, which result in water passing right through the coil B, this water is separated out at D and carries away by the drain below any scaly matter which may have been deposited in the coil B.—*May 16th, 1935.*

TRANSFORMERS AND CONVERTERS.

428,653. June 28th, 1934.—ELECTRODE CONDUCTORS IN ION VALVES, Allmänna Svenska Elektriska Aktiebolaget, Västeras, Sweden.

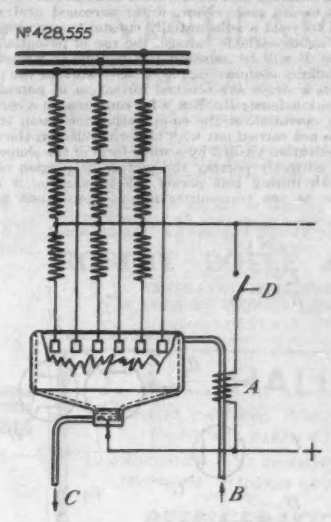
When an electric current traverses a fluid, either a liquid or an ionised gas, the electro-dynamic forces always tend to contract the conducting strand or column of fluid. When the fluid consists of a highly rarified gas or vapour which is intended to admit the current only in one direction, it is known that this valve action ceases, or, at least, is jeopardised as soon as the gas or vapour pressure rises above a certain value. A strong contraction of the conducting gas or vapour column involves, however, a local increase of pressure which has about the same result as a general increase of pressure, and it is probably this circumstance which has caused the fact that in high-power ionic valves—that is to say, valves having liquid cathodes—the current per anode can generally not exceed a certain absolute value without the risk of back-arcing. The object of the invention is to provide an arrangement for counteracting the contraction of the conducting vapour or gas column in such high-power ionic valves. Each anode conductor is passed through the corresponding cathode or *vice versâ*, and through the vapour or gas column between anode and cathode. There is thus provided a return for the current passing through the conducting vapour or gas column in such a manner that the repulsion between the two oppositely directed currents causes an expansion of the vapour or gas column. The conductor A to the anode B is carried through the cathode. The latter consists of a quantity of mercury C resting in a bowl D, which is insulated from the rest of the vacuum vessel wall by a packing E. The bottom of the bowl is traversed by an insulator bushing F for the anode conductor A, which is further surrounded by a tube G—for instance, of quartz—which insulates it thermally and electrically



from the surrounding space containing the arc and prevents the latter from choosing its upper foot point in a place other than on the anode proper B. The latter is surrounded by a sleeve H, which, in the direction towards the cathode, terminates in a grid J, which is carried by a projection on the insulating tube G. The sleeve and the grid may be arranged for impressing a control voltage, for instance, by means of a conductor K leading in from above through an insulating tube. An outer sleeve L serving to guide the arc may be supported by this tube. The active cathode surface is limited by an insulating screen M, above which is arranged a sheet metal screen N serving also to guide the arc. By the concentrical arrangement of the anode conductor and the arc, the latter will be subjected to electro-dynamic forces which counteract its tendency of contraction and thereby reduce the current density, which has the same effect as a reduction of the load, including, as shown by experience, a reduction of the tendency of back-arcing.—*May 16th, 1935.*

428,555. May 15th, 1935.—ARC RECTIFIERS, *The English Electric Company, Ltd., Queen's House, Kingsway, London, W.C.2.*

In order to prevent the extinction of the arc in mercury vapour rectifiers when working at reduced loads, it has been proposed either to maintain an artificial minimum load or to preheat the cooling water circulated round the rectifier chamber. The inventors combine the two ideas and use a shunt A across the terminals of the rectifier to warm the cooling water passing

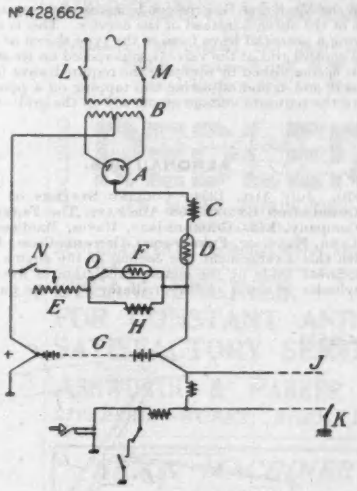


through the circuit B–C. The switch D in the shunt may be operated automatically.—*May 16th, 1935.*

BATTERIES AND ACCUMULATORS.

428,662. September 25th, 1934.—CHARGING OF ELECTRIC BATTERIES, *H. A. Gill, 51–52, Chancery-lane, London, W.C.2.*

The arrangement shown in the drawing has a rectifier A which can be connected through the transformer B to alternating current mains. In the charging circuit there is a relay C which is energised as soon as the charging current flows, and an iron-hydrogen resistance D. A resistance E and an iron-hydrogen F are arranged so that they can be shunted across the battery G, and the winding of a relay H, which is energised by the voltage at the terminals of this resistance when the voltage of the battery increases, is connected in parallel with the resistance F. When current is taken from the battery through a line J, the contact K of an energising circuit is closed by means not shown in the drawing, and a relay is caused to actuate its contacts L and M, which connect the primary winding of the trans-



former B to the alternating current mains. In this way, the charging circuit is closed and the relay C actuates its contacts N and O. The contact O thus connects the resistance E, which has a low-temperature coefficient of resistance, the iron-hydrogen resistance F, which has a high temperature coefficient of resistance, and the relay H, which is a voltage-testing relay in parallel with the battery G, while the contact N closes a holding circuit through the windings of the relay, so that the relay is maintained actuated independently of the actuating of the contact K. As soon as the terminal voltage of the battery rises to the value at which the charging circuit is to be opened, the relay H responds owing to the increased voltage drop at the iron-hydrogen resistance F and actuates its contacts and interrupts the holding circuit for the relay. If the contact K is open at this instant, then the relay releases and interrupts the charging. The relay C releases and opens the voltage control circuit through its contact N.—*May 16th, 1935.*

TELEGRAPHS AND TELEPHONES.

428,557. December 30th, 1933.—TELEVISION APPARATUS, T. M. C. Lance, D. M. Johnstone, and Baird Television, Ltd., 58, Victoria-street, London, S.W.1.

In Fig. 1 a thermionic discharging device A is connected with its anode and cathode joined to opposite poles of a condenser B and also to opposite plates of a pair of deflector plates C D of a cathode ray tube television reconstituting device. Charging current is supplied for the condenser by a source of potential of which the positive pole is connected at E and the negative at F, and this charging current is controlled in value by the cathode anode space impedance of a screened grid thermionic valve G. The control grid of this valve is negatively biased with respect to the cathode by a potential applied between points H and F, while the screen grid is given a steady positive potential with respect to the grid by means of a suitable source connected to points J and F. The discharge device A is provided with a grid, maintained at a suitable negative potential with respect to the cathode thereof, and periodic synchronising impulses are applied to it by way of the point K *vid* an impedance network. In operation, as the voltage of the condenser B rises, a point is reached depending on the value of the negative bias of the grid of the discharge device A, whereat current begins to flow through the discharge device and the voltage across the condenser is reduced to a low residual value again. If the discharge device comprises a gas discharge triode, the discharge is spon-

taneous and is merely controlled in periodicity by impulses applied at K; but if the discharge device comprises a low-impedance thermionic valve (for example, a pentode) the discharge is initiated and its duration determined by the applied impulses on its grid. Now, if the screened grid valve G is adjusted to yield a substantially constant current within wide limits of anode-cathode voltage, the rise of potential across the condenser B will be substantially rectilinear with time; this state of affairs is shown in Fig. 2 at *c*, wherein the pulse curve represents a single saw-toothed formation of potential change across the condenser B. But if for some reason a corresponding scanning operation at the co-operating television transmitting station is not carried out with uniform velocity, the component of reconstitution yielded by a wave form of the shape *c* of Fig. 2 will not correctly portray the picture or portion of a picture dealt with during this period. For example, if a scanning operation at the transmitter follows some such law as that

Nº 428,557

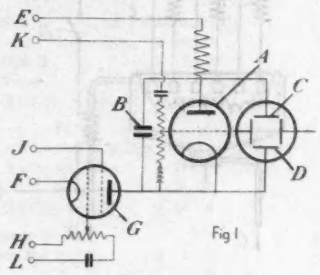


Fig 1

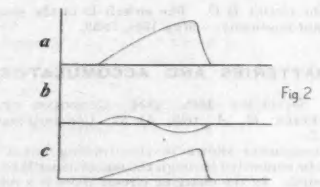


Fig 2

represented by the curve *a* of Fig. 2, wherein ordinates represent scanning displacement and abscissæ time, at the receiver, where the displacement-time curve, of course, corresponds with the potential-time curve *c*, the picture or segment of a picture dealt with will be bunched up at an initially reconstituted portion and unduly spread out at a finally reconstituted portion during the time represented. Distortion is substantially annulled by applying a correcting control to the "constant-current" device G so that actually it no longer passes a constant current, but one which varies in such a manner that the rise of voltage across the condenser B corresponds instant by instant with the shape of the curve *a* instead of the curve *c*. This is effected by applying a potential wave form of the type shown at *b* in Fig. 2 to the control grid of the valve G, superposed on its steady bias. This is accomplished by applying the required wave form across points H and L and adjusting the tapping on a potentiometer to give the requisite voltage amplitude on the grid.—*May 15th*, 1935.

AERONAUTICS.

428,570. July 31st, 1934.—COOLING SYSTEMS OF INTERNAL COMBUSTION ENGINES ON AIRCRAFT, The Fairey Aviation Company, Ltd., Cranford-lane, Hayes, Middlesex, and G. Lyon, Ranmoor, Fulmer-road, Gerrards Cross, Bucks.

With this arrangement the cooling of the engine is effected at moderate loads by the simple circulation of water through the cylinder jacket A and the radiator B by the pump C. At

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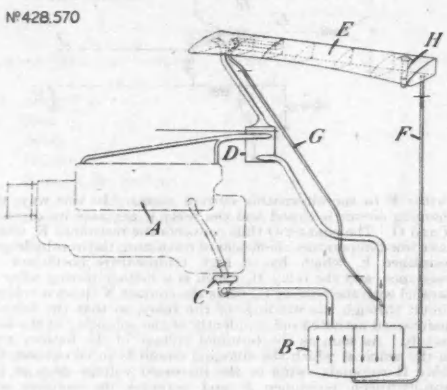

higher loads part of the circulating water is evaporated in the jacket, and the resulting steam is separated in the centrifugal separator D. This steam goes to a condenser E, forming the front edge of the aeroplane's wing, and the condensate is returned to the circuit by the pipe F. Any water carried up into the condenser by the steam is returned by the pipe G. An atmospheric vent is provided at H, but the proportions of the apparatus are such that air cannot be drawn into the circuit.—*May 15th*, 1935.

MACHINE TOOLS AND SHOP APPLIANCES.

428,427. August 11th, 1934.—APPARATUS FOR GRINDING VALVE SEATS, Van Norman Machine Tool Company, 160, Wilbraham-avenue, Springfield, Mass., U.S.A.

The inventors complain that in the usual system of grinding in valve seats by means of a formed abrasive wheel there is a liability for the wheel to chatter and produce a bad surface. As a consequence they deliberately put the grinding spindle out of balance by means of the weighted disc A. They say that it is their belief that the use of an unbalanced rotating weight acts in several distinct ways to improve the operation of the grinding wheel. The grinding system, including the pilot, sleeve, grinding wheel, and drive, has a tendency to vibrate or chatter with a frequency dependent upon the physical dimensions and properties of the several parts. The weight of the loaded disc exerts a very considerable effect upon the natural period of the system and apparently removes this period so far from that of the external forces tending to create the vibrations that these are practically damped out.—*May 13th*, 1935.

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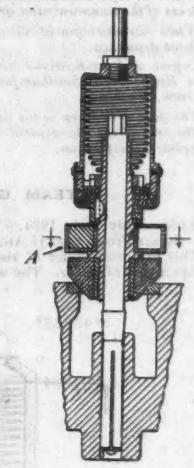

BUILDING.

428,556. December 28th, 1933.—METALLIC PAVING BLOCKS, J. Zimmermann, 43 bis Rue de Metz, Longwy-Bas (Meurthe et Moselle), France.

This invention is concerned with metallic paving blocks and chiefly with their secure attachment to the base. The illus-

Nº 428,556

Fig 1

Fig 2.

trations show, in Fig. 1, the adjacent edges of two blocks and, in Fig. 2, the design at the centre of each block. It will be seen that the down-turned edges, or flanges, of the blocks form a dovetailed connection with the plastic base, while at the centre of the block there protrudes a rivet-like extension of the base.—*May 15th*, 1935.

MISCELLANEOUS.

428,433. December 17th, 1934.—MAKING FIBRES FROM GLASS, SLAG, AND THE LIKE MELTABLE MATERIALS, Naamlooze Vennootschap Maatschappij tot Beheer en Exploitatie van Octrooien, No. 57, Zeekant, The Hague, Holland.

The material which is commonly known as slag wool is produced, according to this process, by a combination of

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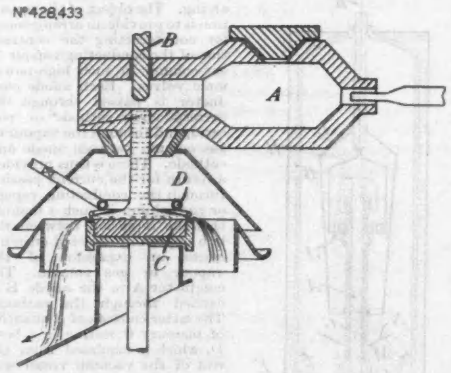

centrifuging and an air blast. The molten slag passes from the chamber A through an orifice controlled by the plug B on to the rapidly rotating disc C. It is thrown off this disc in the form of a mattress of fine threads and the action is accelerated by a blast from a ring of jets D that may be of steam, air, or a gas.—*May 13th*, 1935.

END OF VOL. CLIX.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TODAY AND SATURDAY, JUNE 29TH.

BRITISH WATERWORKS ASSOC.—Summer Meeting at Cambridge. For provisional programme see page 382, April 12th.

SATURDAY, JUNE 29TH.

KEIGHLEY ASSOC. OF ENGINEERS.—Visit to works of Thomas Firth and John Brown, Ltd., Sheffield. Private coach leaves Russell-street, Keighley, 1.15 p.m.

SOC. OF GLASS TECHNOLOGY: LONDON SECTION.—Visit to factory of Frank Cooper, Ltd., Oxford, and the Colleges.

TUESDAY TO FRIDAY, JULY 2ND TO 5TH.

INST. OF BRITISH FOUNDRYMEN.—Annual Conference at Sheffield. For programme see page 608, June 7th, 1935.

WEDNESDAY, JULY 3RD.

INST. OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—Visit to the works of the Derwent Valley Water Board near Sheffield. Members will depart by motor coach, leaving the White Horse Hotel, Congreve-street, Birmingham, at 8.45 a.m.

THURSDAY, JULY 11TH.

INST. OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, W.C.2. Conversazione to overseas members.

INST. OF ELECTRICAL ENGINEERS: S. MIDLAND CENTRE.—Annual Summer Meeting. Leave Birmingham, New-street, for Liverpool, 8.30 a.m.; visit Mersey Tunnel, Liverpool; luncheon at Hulme Hall, as guests of Messrs. Lever Brothers, 1 p.m.; tour of Port Sunlight works, 2 p.m.; leave for New Brighton, 4.30 p.m. Full particulars from the hon. secretary, Mr. H. Hooper, 54, New-street, Birmingham.

THURSDAY AND FRIDAY, JULY 11TH AND 12TH.

INST. OF MINING ENGINEERS.—Summer meeting at Newcastle-upon-Tyne. Thursday, general meeting at the House of the North of England Institute of Mining and Mechanical Engineers, Neville Hall. The following papers will be submitted for discussion:—"The Grading and Classification of Coal," Mr. H. Eustace Mitton; "Surface Coal Cleaning *versus* Clean Mining," Messrs. George Raw and F. F. Ridley; "Coal and the Marine Engineer," Engineer-Commander Townend; "Cleaning Plant at the Rising Sun Colliery, Wallsend," Mr. Kenelm C. Appleyard. 10 a.m. Luncheon at the Old Assembly Rooms, Westgate-road. 1.30 p.m. Visit the Rescue Station of the Durham and Northumberland Collieries Fire and Rescue Brigade, Elswick. 2.45 p.m. Or alternatively visit the cleaning plant at the Rising Sun Colliery of the Wallsend and Hebburn Coal Company, Ltd. 2.45 p.m. The Institution of Mining Engineers dinner at the Grand Assembly Rooms, Barras Bridge. 7.45 p.m. Friday, leave Neville Hall, 9.30 a.m., for The Chesters, arriving at 10.30 a.m. Luncheon at Otterburn Hall, 1 p.m. Reception and dance, by kind invitation of the Lord Mayor and Corporation of Newcastle-upon-Tyne, at the Grand Assembly Rooms, Barras Bridge. 9 p.m. to 1 a.m.

LAUNCHES AND TRIAL TRIPS.

ABOSSO, motor vessel; built by Cammell Laird and Co., Ltd., to the order of the Elder Dempster Lines, Ltd.; dimensions, 457ft. by 65ft. by 37ft.; to carry passengers and cargo. Diesel engines, Burmeister and Wain's type; constructed by John G. Kincaid and Co., Ltd., Greenock; launch, June 19th.

ARGENTINE TRANSPORT, single-screw steamer; built by the Blythswood Shipbuilding Company, Ltd., to the order of British owners; dimensions, 420ft. by 55ft. by 34ft. 6in.; to carry cargo. Engines, triple inverted direct-acting surface condensing, 22½in., 36in. and 65in. by 45in. stroke; constructed by David Rowan and Co., Ltd.; launch, June 19th.

KARU, single-screw motor vessel; built by Alexander Stephen and Sons, Ltd., to the order of the Union Steamship Company of New Zealand, Ltd.; dimensions, 230ft. by 35ft. by 16ft.; to carry cargo. Diesel engines of Stephen-Sulzer six-cylinder type; constructed by the builders; launch, June 19th.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THOMSON AND BROWN BROS., Ltd., are opening a new branch in South Henry-street, Carlisle, on July 8th.

MR. P. W. MCGUIRE has resigned his position as managing director of Armstrong-Saurer Commercial Vehicles, Ltd.

TATA, LTD., are moving to new offices at Thames House, Millbank, London, S.W.1. Telephone numbers, Victoria 3462 (four lines); telegraphic address, "Tatald, Sowest, London."

GEORGE COHEN SONS AND CO., Ltd., of 600, Commercial-road, London, E.14, have purchased the whole of William Whitwell and Co., Ltd.'s plant at Thornaby Ironworks, Stockton-on-Tees.

THE FOSTER INSTRUMENT COMPANY, Ltd., Letchworth, reports that, to cope with the continued increase in business, extensions to its works are now in course of erection, and will provide an additional 40 per cent. manufacturing space within the next few weeks.

Printing.—George Reveirs, Ltd.
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(Illustrated Advertisement in issue of June 7, page 8)

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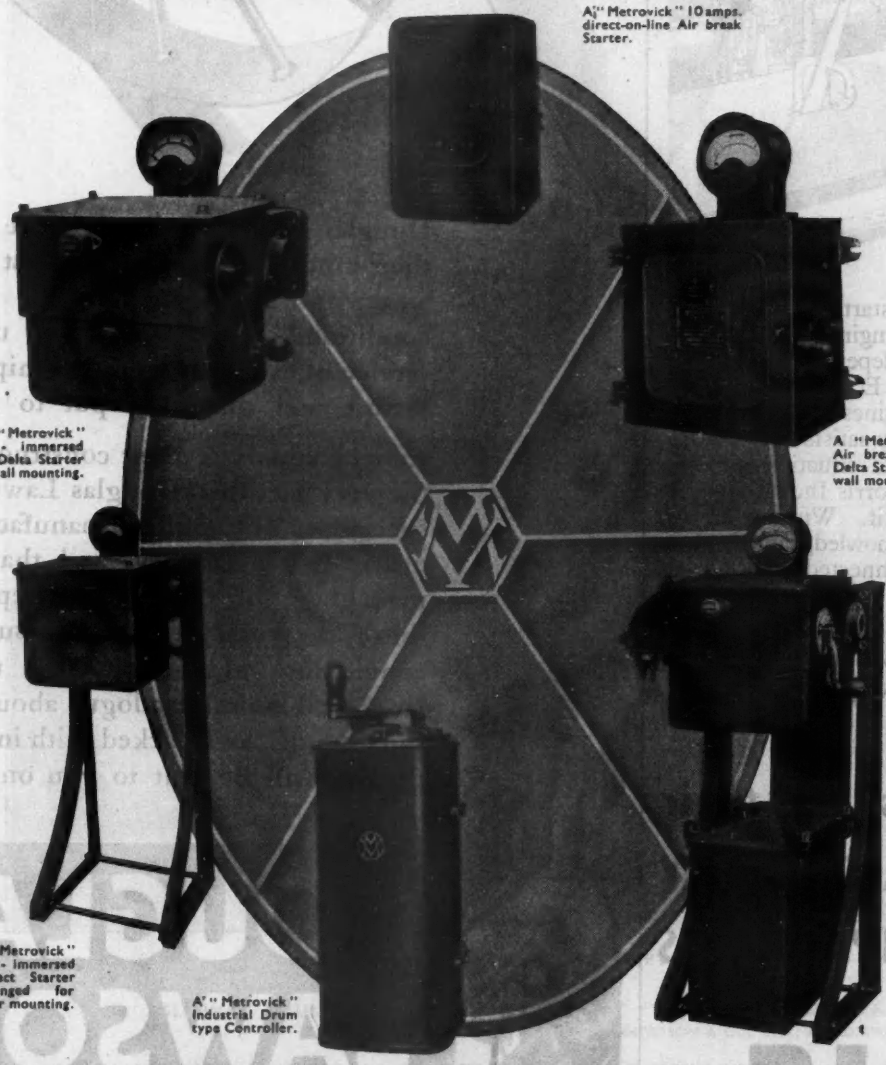
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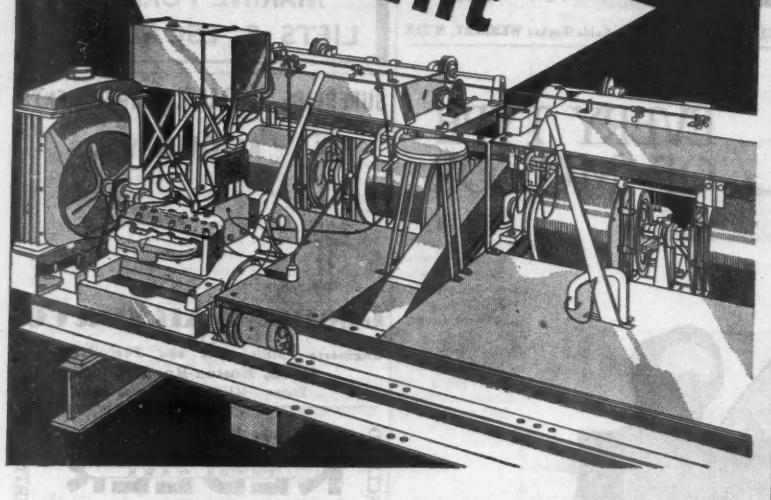

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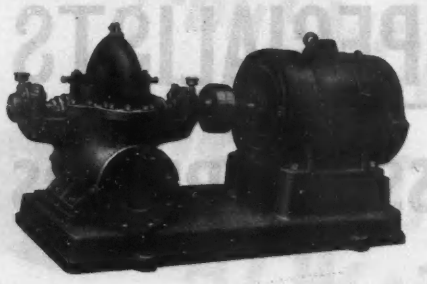

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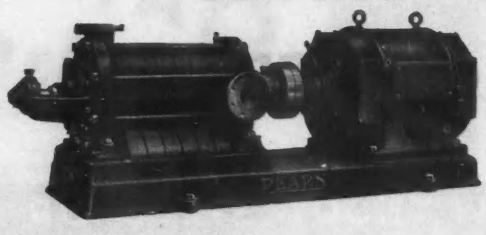

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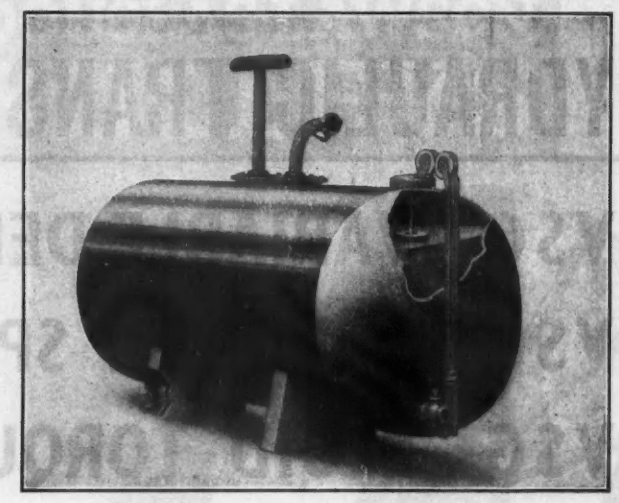

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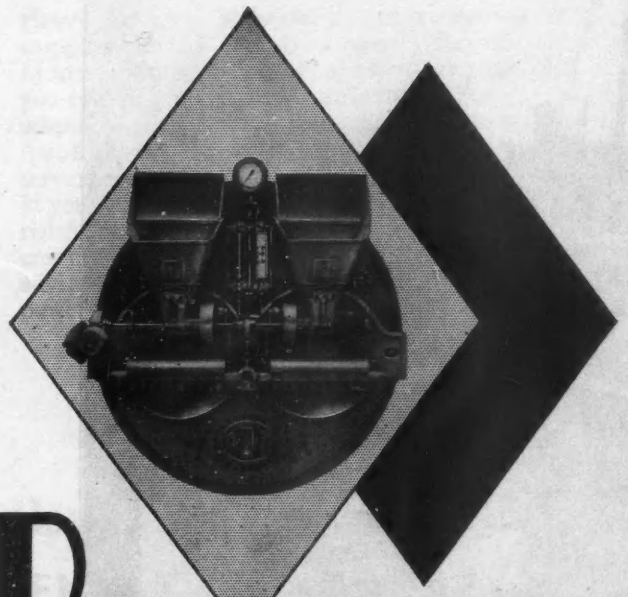

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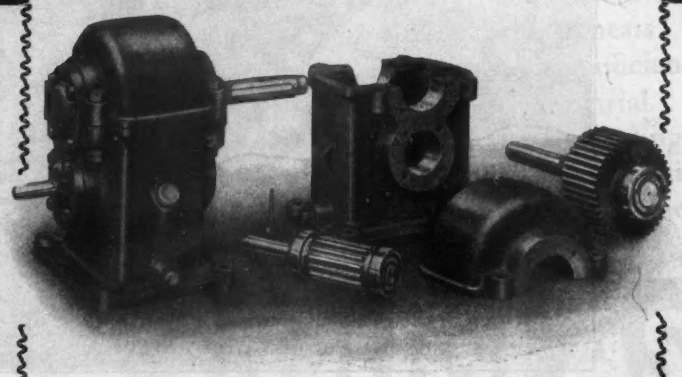

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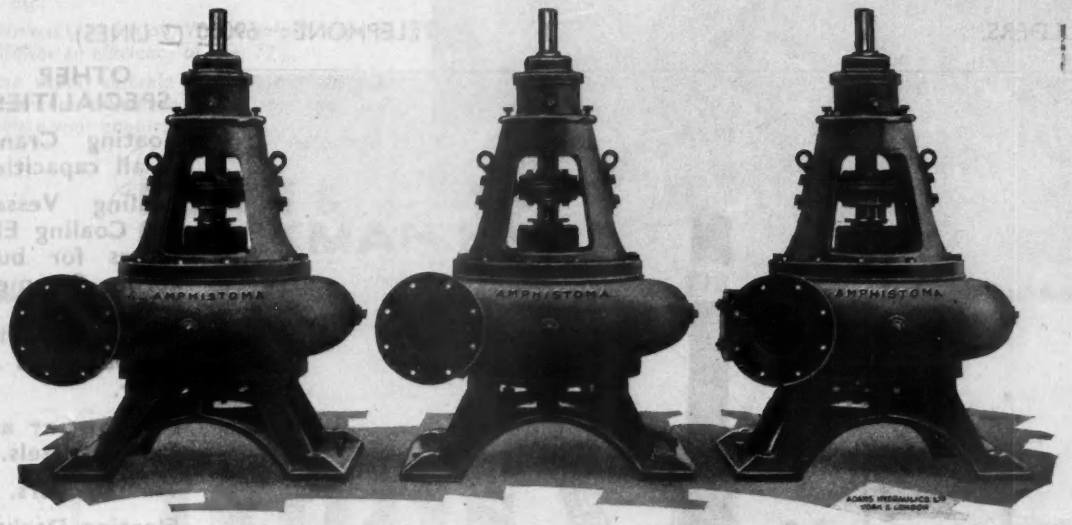

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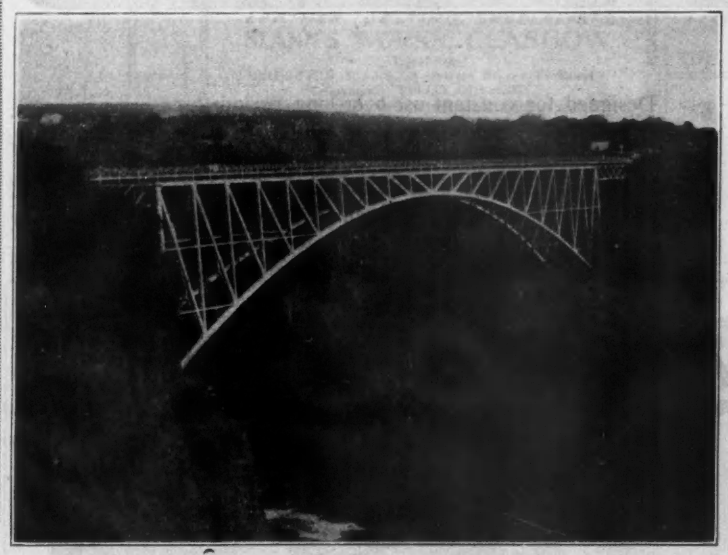

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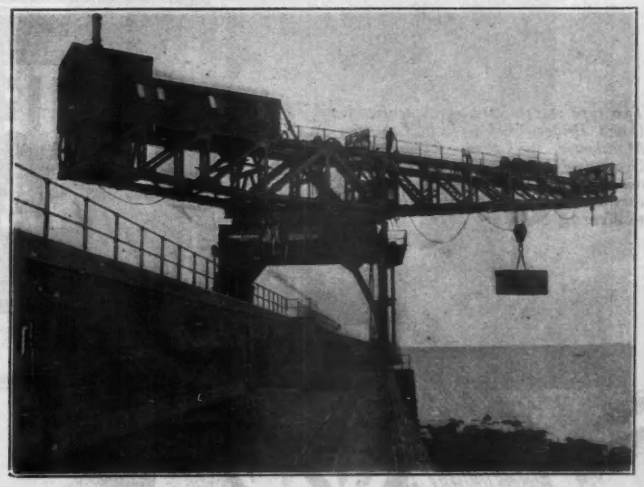

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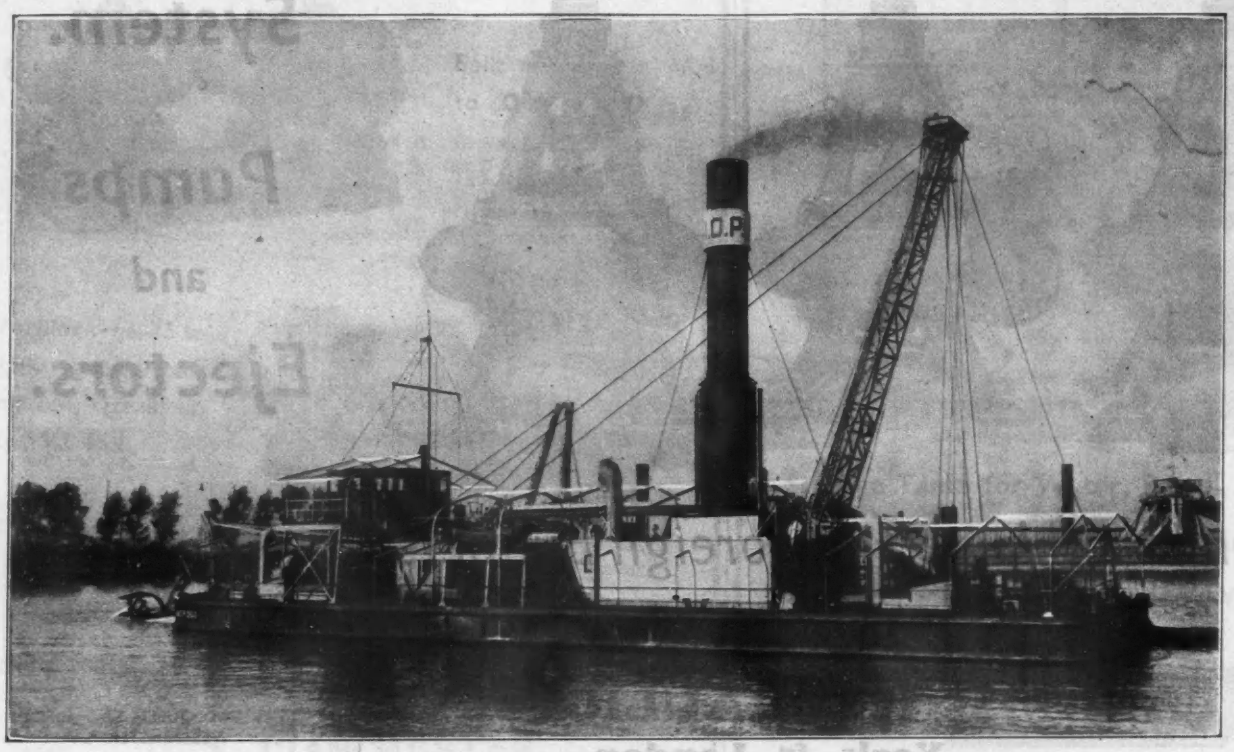

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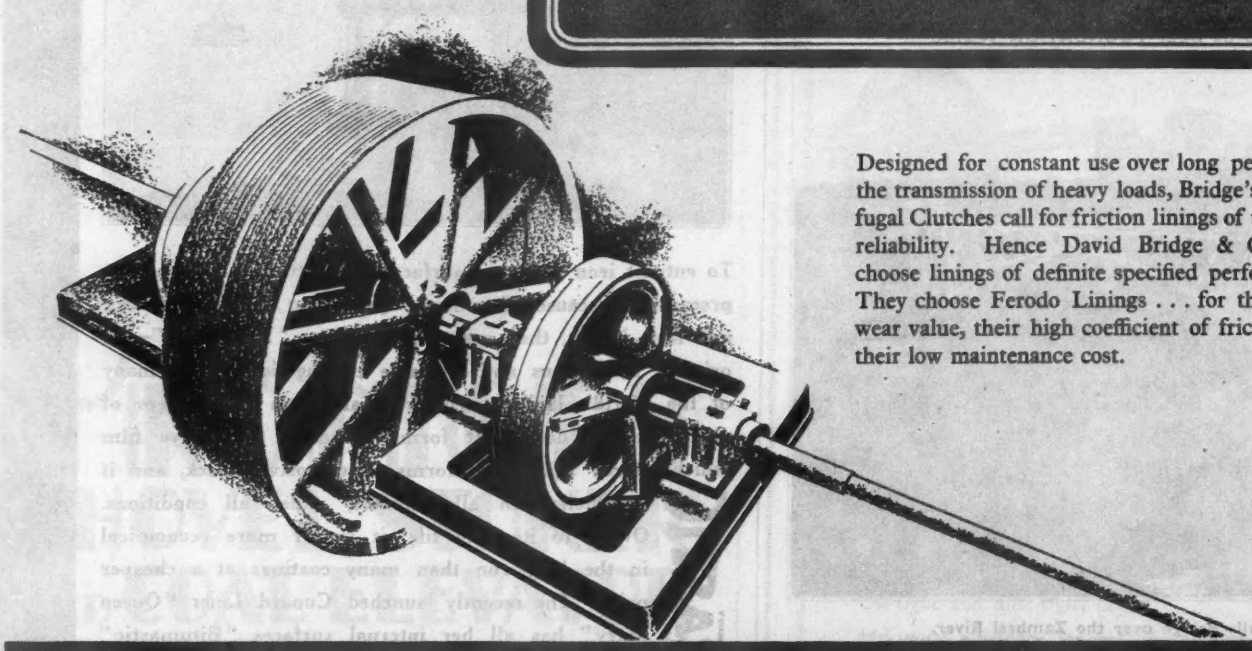

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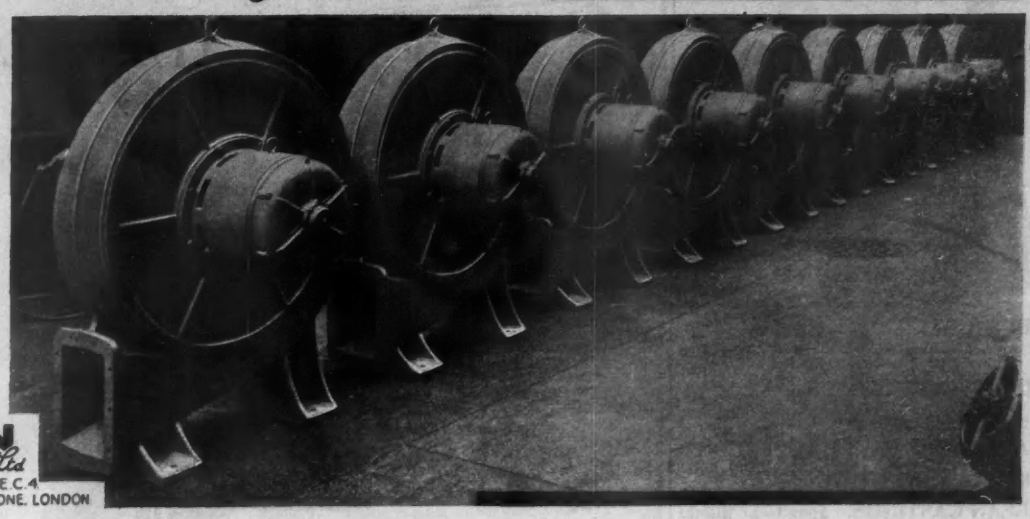

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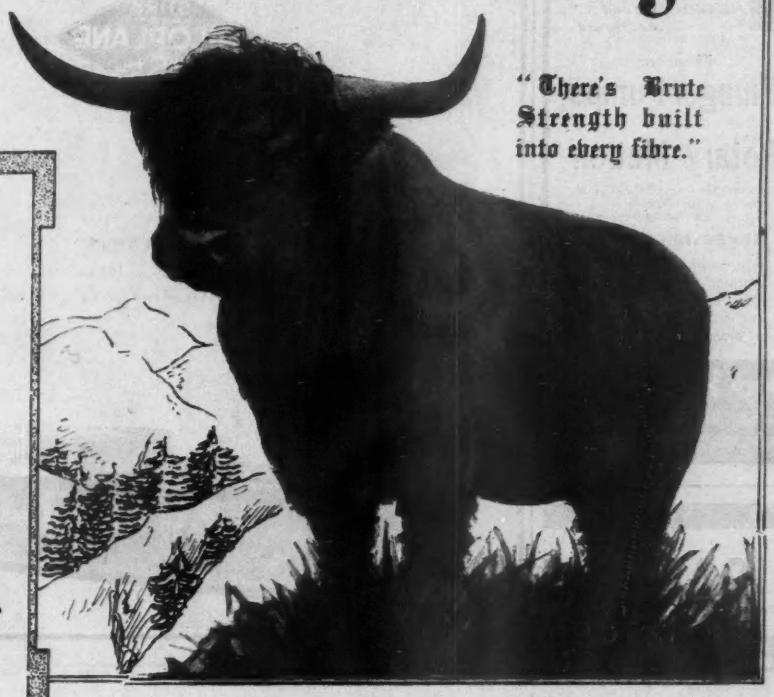

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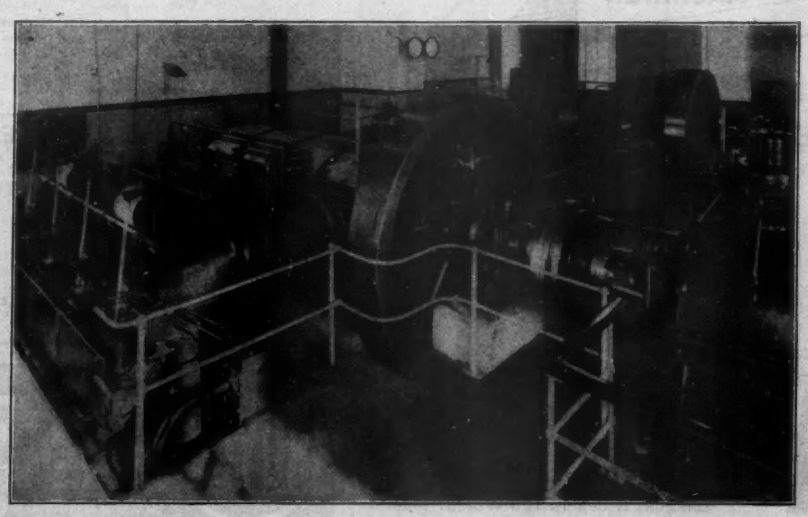

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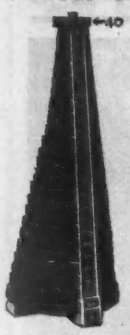

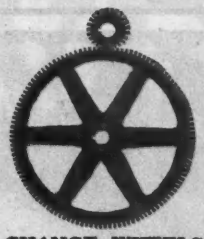

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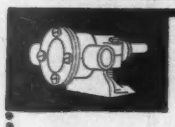

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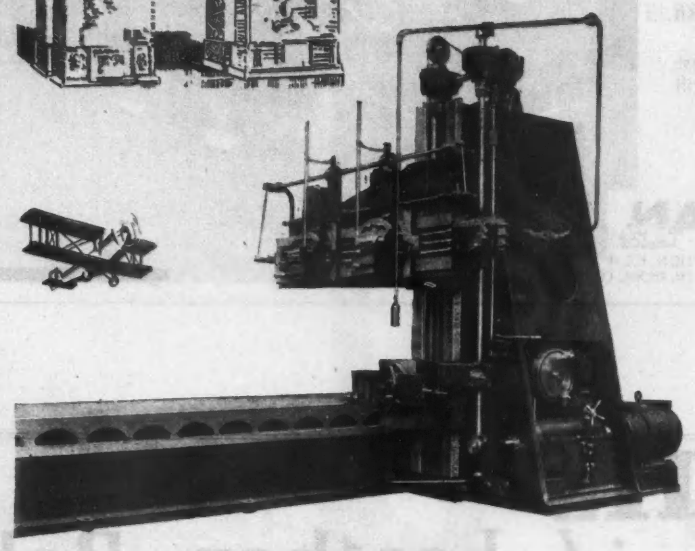

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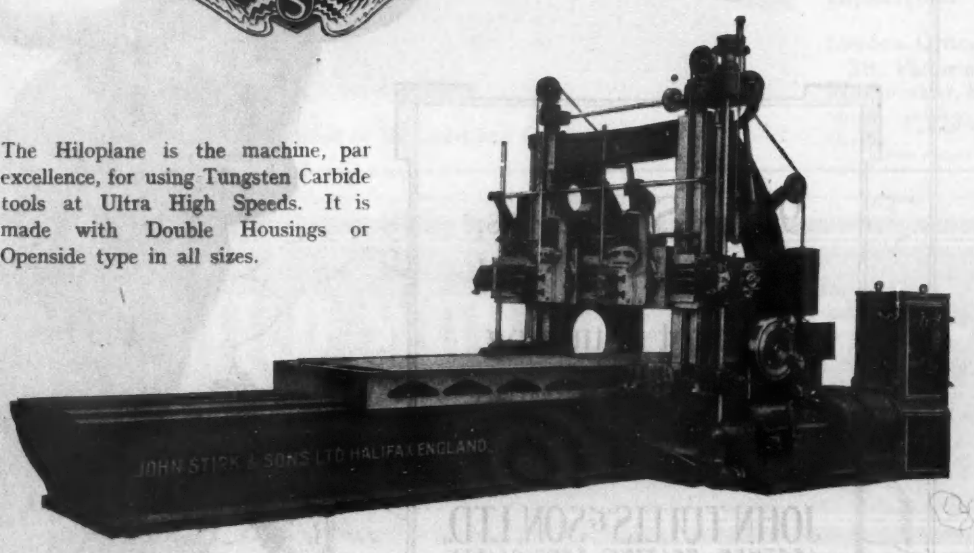

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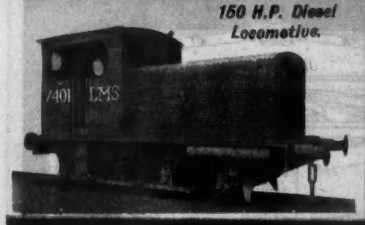

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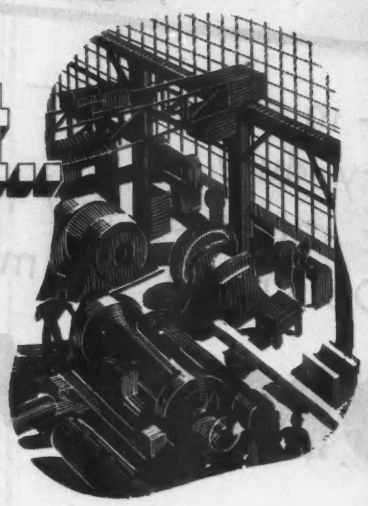

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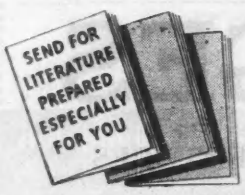

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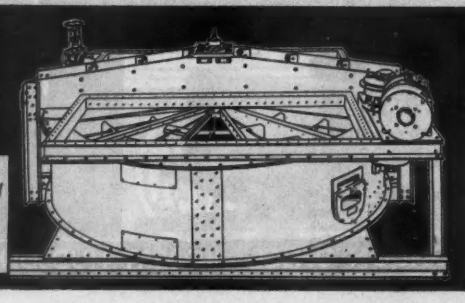

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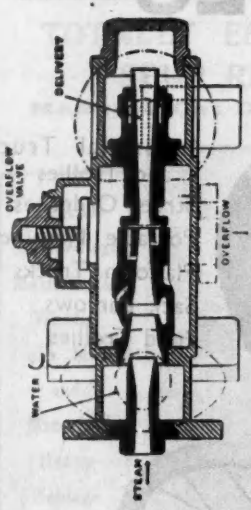

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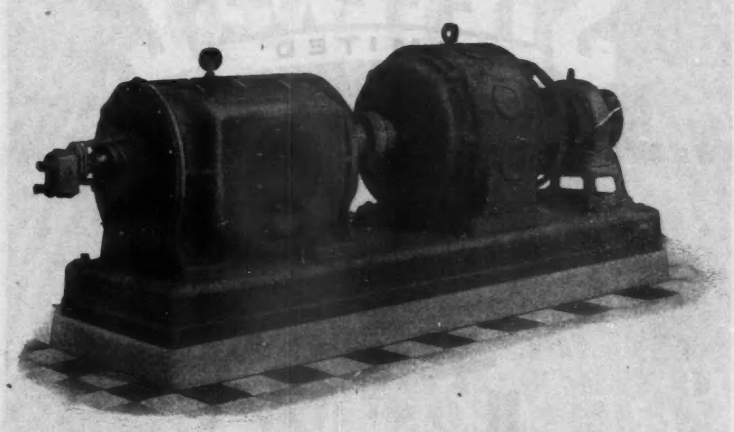
ROLLING DRUM TYPE.



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¶ The blades are restrained on their periphery by a freely rotating perforated drum, friction and wear being thus reduced to a minimum.

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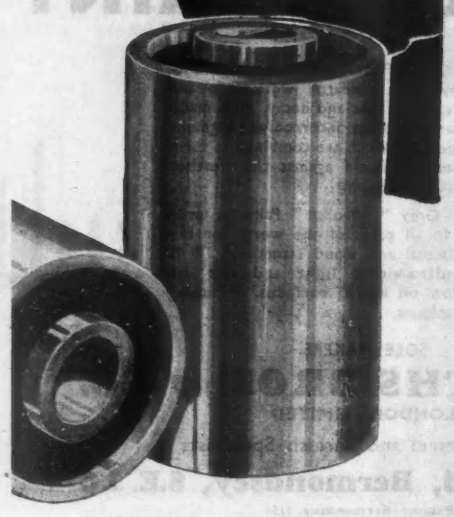

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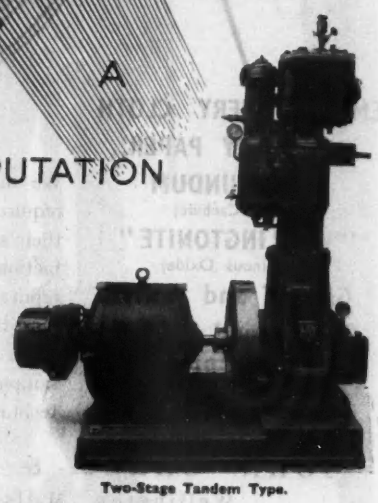

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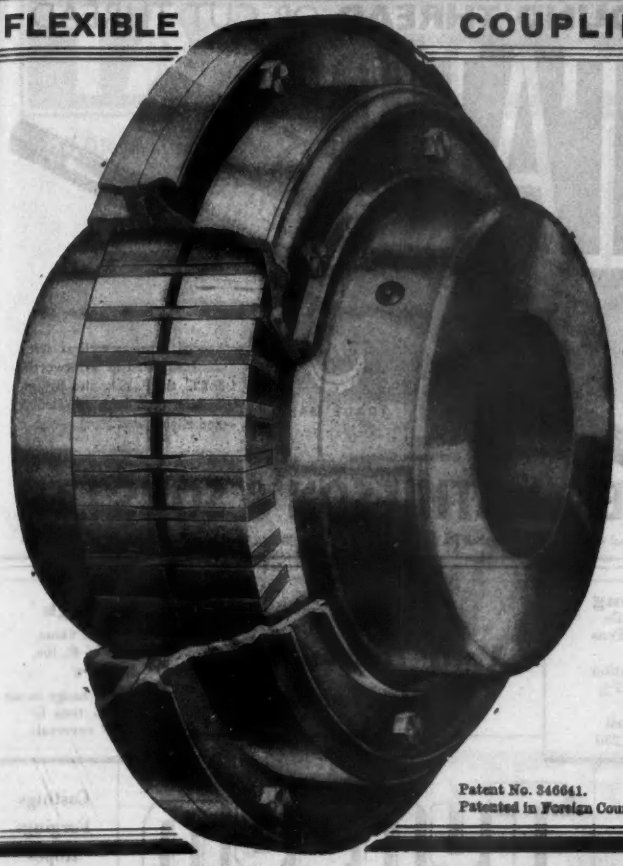

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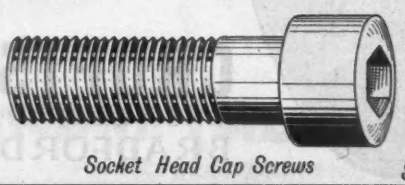

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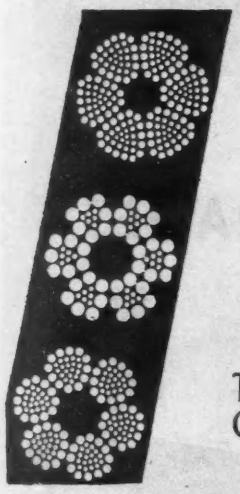

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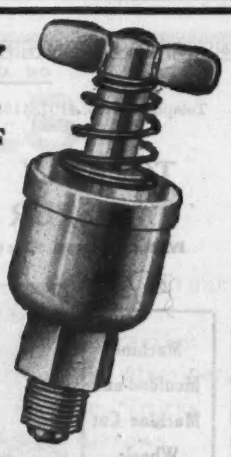

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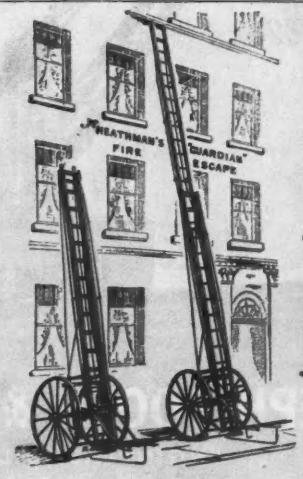

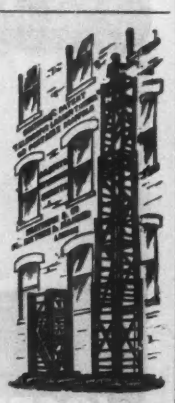

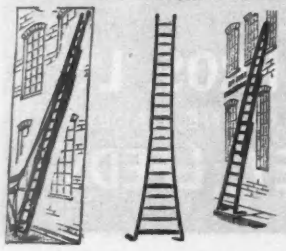

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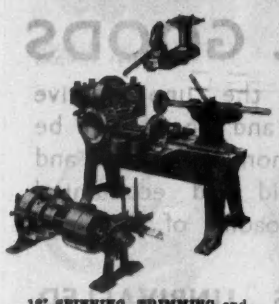

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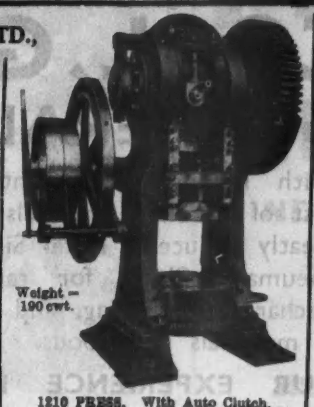

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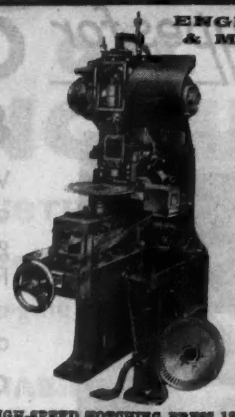

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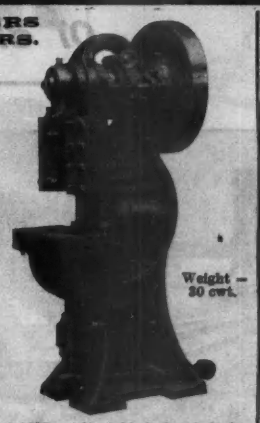

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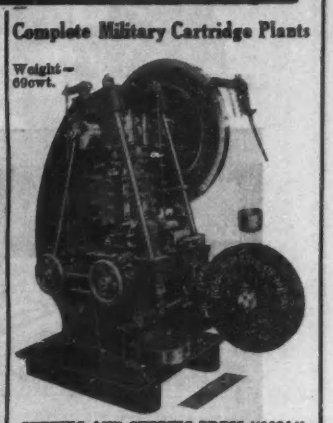

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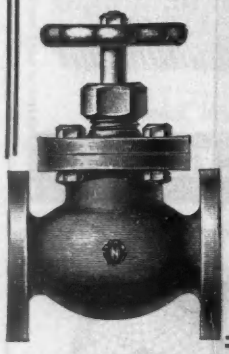

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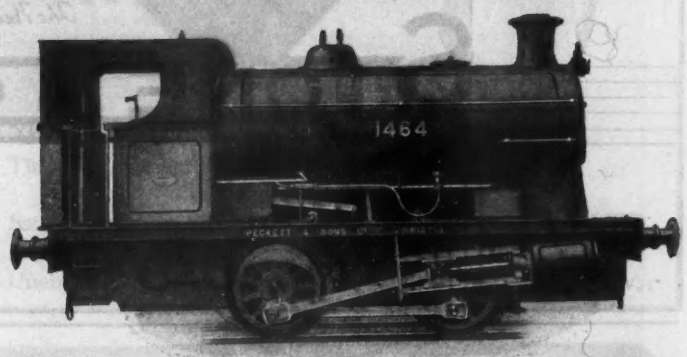

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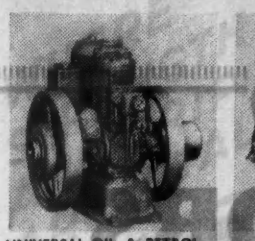
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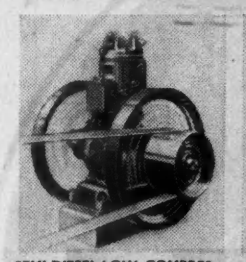
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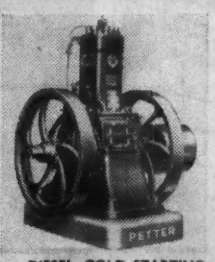
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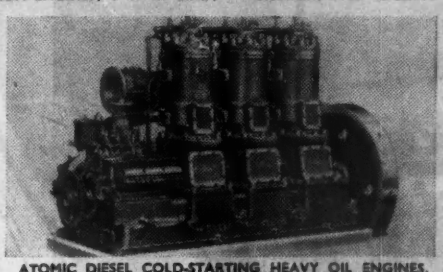
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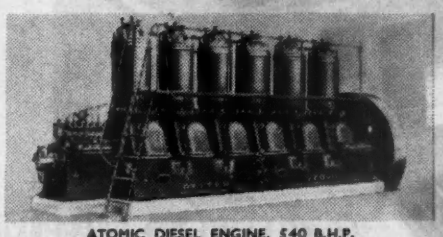
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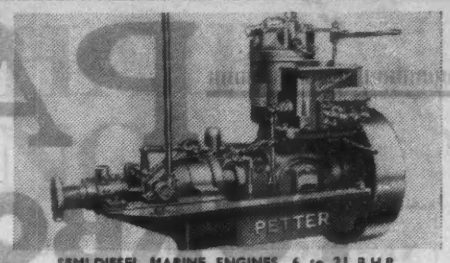
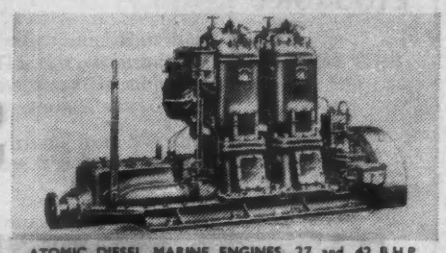

SEMI-DIESEL MARINE ENGINES, 6 to 21 B.H.P.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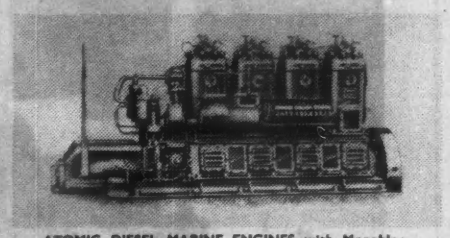
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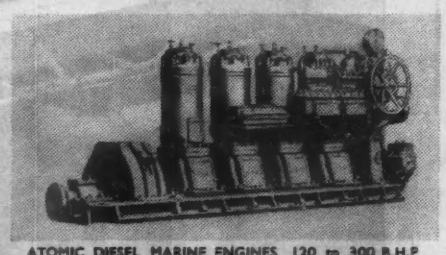
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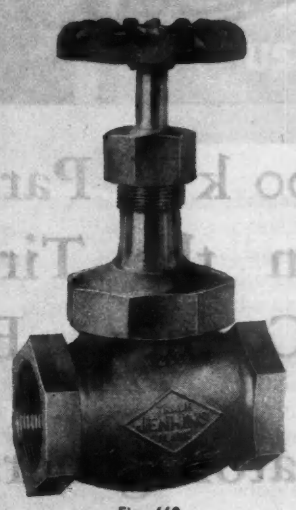

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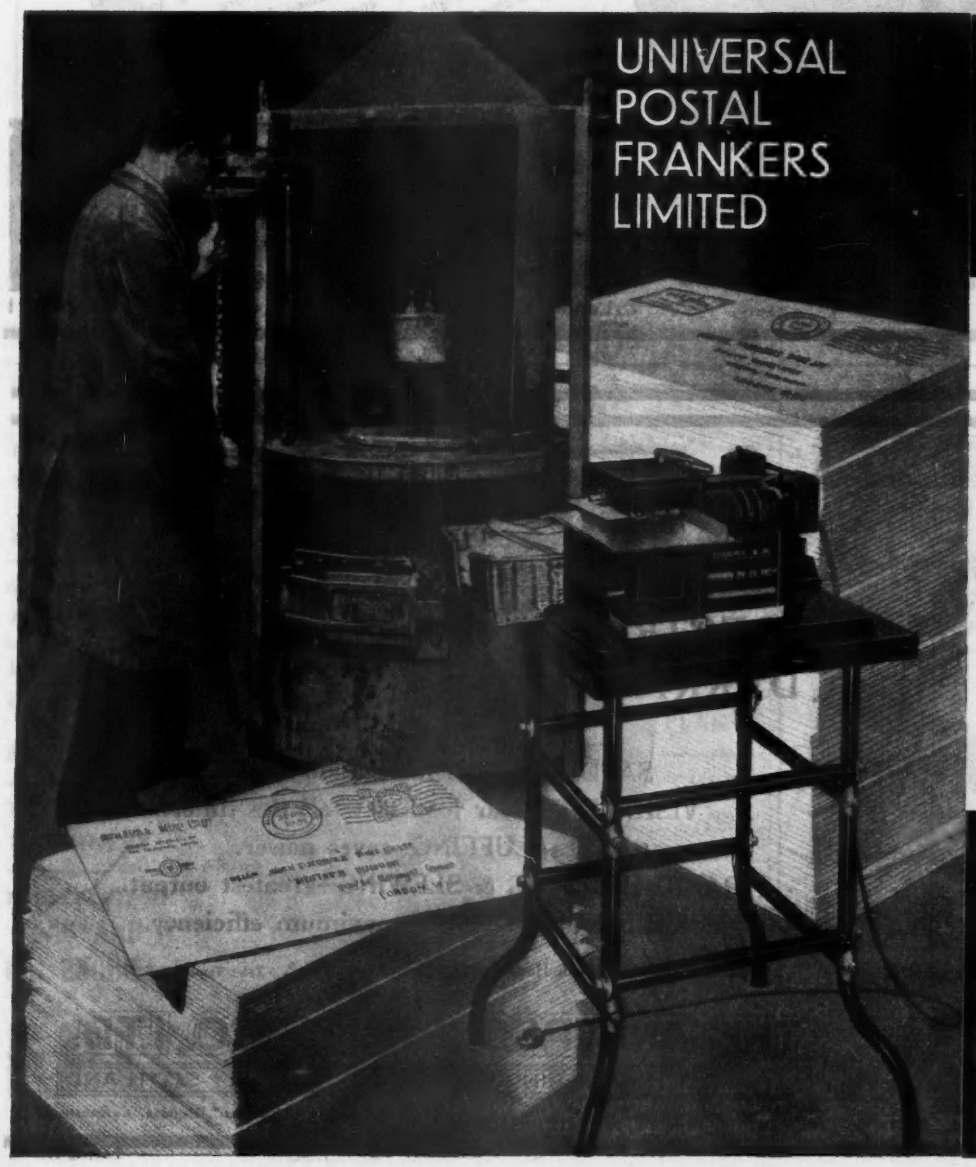

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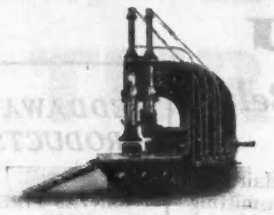

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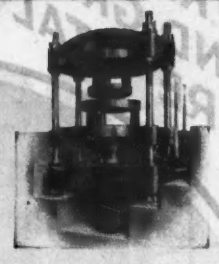

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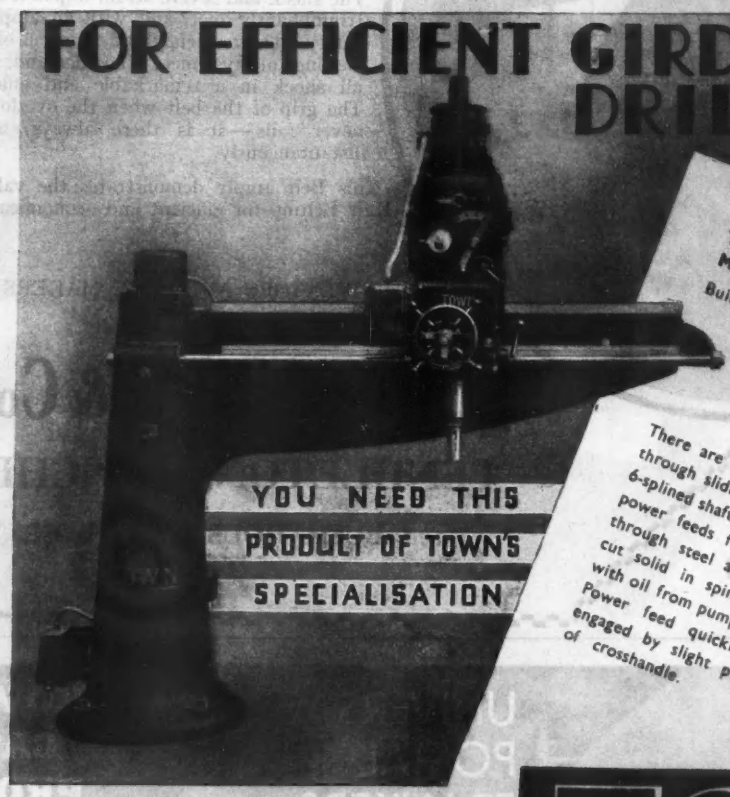

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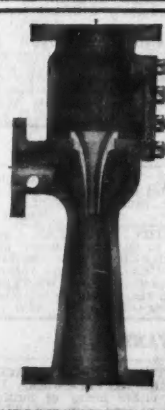

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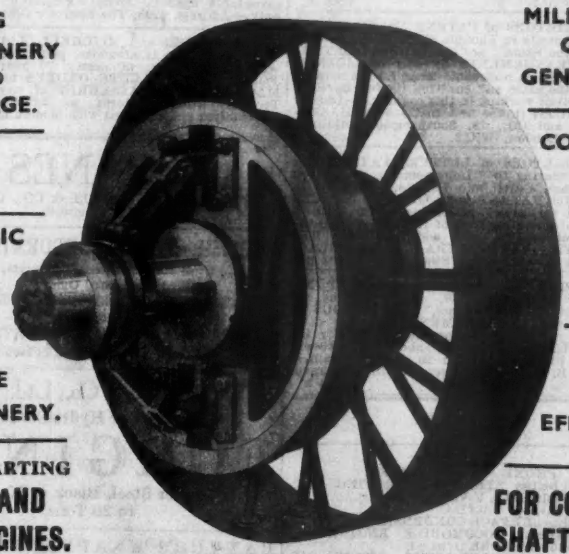

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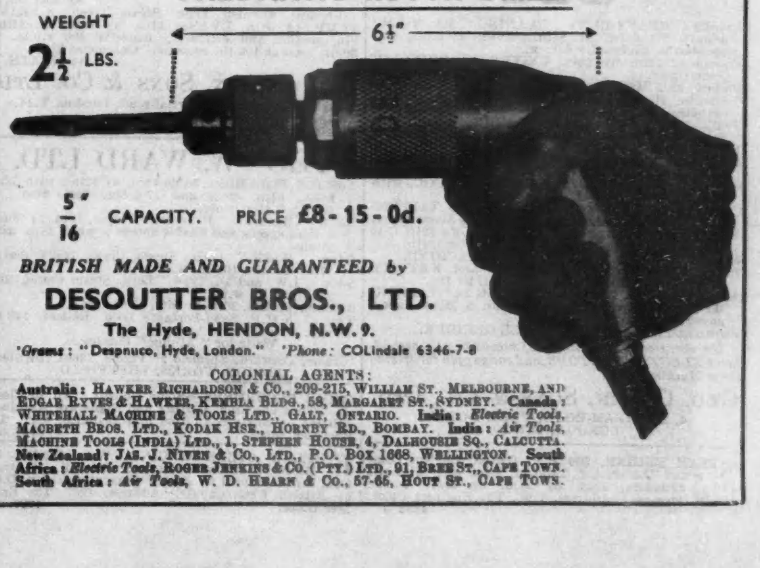

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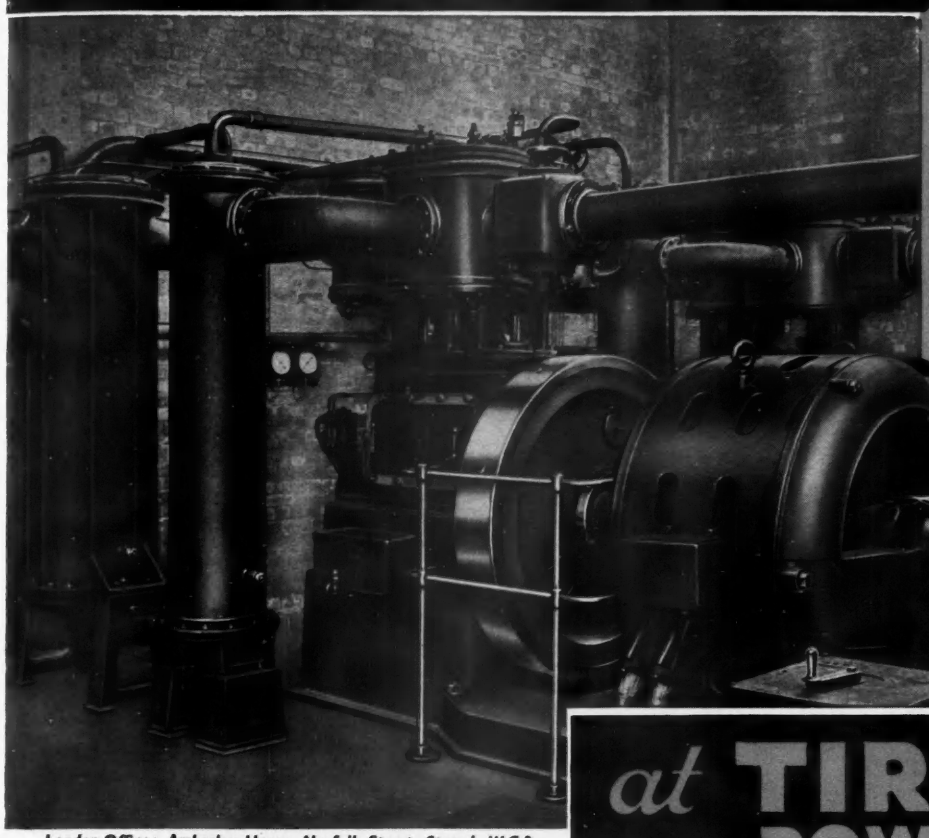

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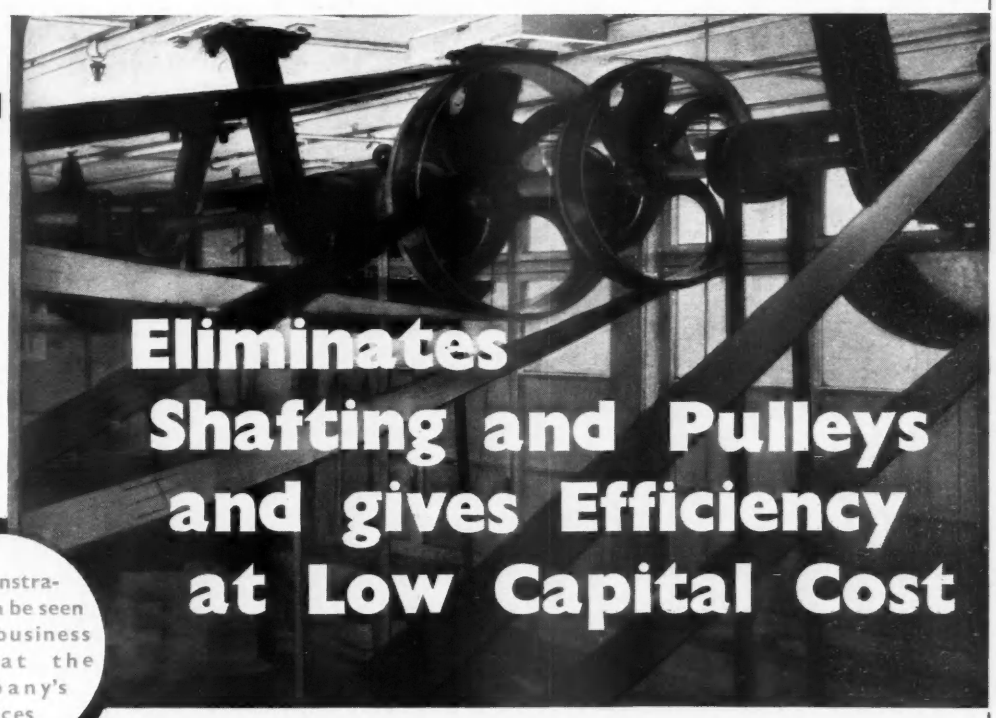

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